FERRY VESSEL SAFETY ON PUGET SOUND

HEARING

BEFORE THE

SUBCOMMITTEE ON
COAST GUARD AND NAVIGATION

OF THE

COMMITTEE ON
MERCHANT MARINE AND FISHERIES
HOUSE OF REPRESENTATIVES

ONE HUNDREDTH CONGRESS

SECOND SESSION

ON

H.R. 4518

TO AMEND TITLE 46, UNITED STATES CODE, TO ENHANCE THE SAFETY OF PASSENGERS AND EMPLOYEES ON FERRIES OPERATING ON PUGET SOUND

MAY 31, 1988—SEATTLE, WA

Serial No. 100-72

Printed for the use of the
Committee on Merchant Marine and Fisheries

U.S. GOVERNMENT PRINTING OFFICE

89-608 WASHINGTON : 1988

For sale by the Superintendent of Documents, Congressional Sales Office
U.S. Government Printing Office, Washington, DC 20402

H561-15

COMMITTEE ON MERCHANT MARINE AND FISHERIES

WALTER B. JONES, North Carolina, *Chairman*

MARIO BIAGGI, New York
GLENN M. ANDERSON, California
GERRY E. STUDDS, Massachusetts
CARROLL HUBBARD, JR., Kentucky
DON BONKER, Washington
WILLIAM J. HUGHES, New Jersey
MIKE LOWRY, Washington
EARL HUTTO, Florida
W.J. (BILLY) TAUZIN, Louisiana
THOMAS M. FOGLIETTA, Pennsylvania
DENNIS M. HERTEL, Michigan
ROY DYSON, Maryland
WILLIAM O. LIPINSKI, Illinois
ROBERT A. BORSKI, Pennsylvania
THOMAS R. CARPER, Delaware
DOUGLAS H. BOSCO, California
ROBIN TALLON, South Carolina
SOLOMON P. ORTIZ, Texas
CHARLES E. BENNETT, Florida
THOMAS J. MANTON, New York
OWEN B. PICKETT, Virginia
JOSEPH E. BRENNAN, Maine
GEORGE J. HOCHBRUECKNER, New York
BOB CLEMENT, Tennessee

ROBERT W. DAVIS, Michigan
DON YOUNG, Alaska
NORMAN F. LENT, New York
NORMAN D. SHUMWAY, California
JACK FIELDS, Texas
CLAUDINE SCHNEIDER, Rhode Island
HERBERT H. BATEMAN, Virginia
JIM SAXTON, New Jersey
JOHN R. MILLER, Washington
HELEN DELICH BENTLEY, Maryland
HOWARD COBLE, North Carolina
MAC SWEENEY, Texas
CURT WELDON, Pennsylvania
PATRICIA SAIKI, Hawaii
WALLY HERGER, California
JIM BUNNING, Kentucky
ERNEST L. KONNYU, California

EDMUND B. WELCH, *Chief Counsel*
BARBARA L. CAVAS, *Chief Clerk*
GEORGE D. PENCE, *Minority Staff Director*
DUNCAN C. SMITH III, *Minority Chief Counsel*

SUBCOMMITTEE ON COAST GUARD AND NAVIGATION

EARL HUTTO, Florida, *Chairman*

WILLIAM J. HUGHES, New Jersey
GERRY E. STUDDS, Massachusetts
WILLIAM O. LIPINSKI, Illinois
THOMAS R. CARPER, Delaware
OWEN B. PICKETT, Virginia
JOSEPH E. BRENNAN, Maine
GEORGE J. HOCHBRUECKNER, New York
DENNIS M. HERTEL, Michigan
CHARLES E. BENNETT, Florida
MIKE LOWRY, Washington
BOB CLEMENT, Tennessee
WALTER B. JONES, North Carolina
(Ex Officio)

ROBERT W. DAVIS, Michigan
DON YOUNG, Alaska
HERBERT H. BATEMAN, Virginia
HOWARD COBLE, North Carolina
MAC SWEENEY, Texas
CURT WELDON, Pennsylvania
PATRICIA SAIKI, Hawaii
JIM BUNNING, Kentucky
ERNEST L. KONNYU, California

GENE HAMMEL, *Staff Director*
JEANNE TIMMONS, *Professional Staff*
MARSHA CANTER, *Clerk*
SHERRY STEELE, *Minority Professional Staff*

CONTENTS

	Page
Text of H.R. 4518	35
Statement of:	
Anderson, Captain D.A., Chief, Marine Safety Division, 13th Coast Guard District	4
Burnside, R.P., Canadian Coast Guard	18
Davis, Captain Bob, representative of Masters, Mates & Pilots Union; Master, Washington State Ferry Vessels	26
Prepared statement	179
DeCarteret, Capt. John, retired Coast Guard officer	9
Prepared statement	71
Fredback, Capt. Gary (prepared statement)	183
Jacobs, Captain Tom, representative of Masters, Mates & Pilots Union; Master, Washington State Ferry Vessels	26
Lowry, Hon. Mike, a U.S. Representative from Washington	1
Miller, Hon. John R., a U.S. Representative from Washington	2
Parker, Adm. Harold W., Assistant Secretary of Transportation, Marine Division, Washington State Ferries	9
Prepared statement	37
Pascualy, Dr. Ralph, medical director, Pacific Northwest Sleep/Wake Center	19
Sparks, Dr. Patricia J., consultant in occupational medicine	21
Spaulding, Philip, naval architect	9
Prepared statement	65
Tiberio, Armand (prepared statement)	81
Wenk, Dr. Edward, Jr., Professor Emeritus of Engineering, Public Affairs and Social Management of Technology, Department of Civil Engineering, University of Washington	19
Prepared statement	105
Wheeler, Captain Lynda, representative of Master, Mates & Pilots Union; Master, Washington State Ferry Vessels	26
Prepared statement	174
Additional material supplied:	
Burnside, R.P.:	
Inspection certificate	209
Coast Guard:	
Responses to questions of Mr. Lowry for the record	198
Synopsis of inquiry on work hours on Washington State Ferry Vessels	195
Fredback, Capt. Gary:	
Article: "Rotating shifts certain to produce groggy ferry crewmen"	91
Lowry, Hon. Mike:	
Questions for the record to Capt. Gary Fredback	187
Parker, H.W.:	
Responses to questions of Mr. Lowry for the record	211
Pascualy, Ralph A., M.D.:	
The effects of shift work on health, job performance, job satisfaction, and worker productivity	92
Sparks, Patricia J., M.D.:	
Bremerton Work and Crew schedules	165
Health effects of shiftwork in marine transportation	169
Literature Review and Survey of Masters, Mates and Pilots of the Washington State Ferries on Health Indices Relevant to Shift Work	109

Page

Communications submitted:
Burnside, R.P. (Canadian Coast Guard):
Letter of June 6, 1988, to Nancy Tyson 206
Fredback, Capt. Gary (Washington State Ferries):
Letter to Members, Subcommittee on Coast Guard and Navigation 89
Letter of September 26, 1988, to Chairman Hutto 188
Hutto, Hon. Earl:
Letter of July 7, 1988, to Adm. Harold W. Parker with questions for the record 190
Jacobs, Capt. Thomas A.:
Letter of June 7, 1988, to Hon. Mike Lowry 214
Parker, H.W. (Washington State Department of Transportation):
Letter of July 29, 1988, to Hon. Earl Hutto with responses to questions 210
Pascualy, Ralph, M.D. (Providence Medical Center):
Letter of July 26, 1988, to Hon. Earl Hutto 103
Rose, Mary H., M.D. (Providence Medical Center):
Letter of May 16, 1988, to Congressman Earl Hutto 216
Rufe, Capt. R.T. (Coast Guard):
Letter of October 26, 1988, to Hon. Earl Hutto with responses to questions 197
Sparks, Patricia J., M.D.:
Letter of April 14, 1988, to Elton Eilert 161
Yost, Adm. P.A. (Coast Guard):
Letter of May 9, 1988, to Hon. Earl Hutto 193

FERRY VESSEL SAFETY ON PUGET SOUND

TUESDAY, MAY 31, 1988

HOUSE OF REPRESENTATIVES,
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
SUBCOMMITTEE ON COAST GUARD AND NAVIGATION,
Seattle, WA.

The subcommittee met, pursuant to notice, at 2:30 p.m., in Henry M. Jackson Federal Building, 915 Second Avenue, Seattle, WA, Hon. Mike Lowry presiding.

Present: Representatives Lowry and Miller.

STATEMENT OF HON. MIKE LOWRY, A U.S. REPRESENTATIVE FROM WASHINGTON

Mr. LOWRY. We'll call the hearing of the Subcommittee on Coast Guard and Navigation of the Merchant Marine Committee to order.

My name is Mike Lowry, and with us today at the hearing is Congressman John Miller, a very active and valuable member of our committee.

We call the hearing today, and want to thank the Chairman of the Coast Guard Subcommittee, Earl Hutto from Florida, for authorizing this hearing, to look at essentially three safety questions that have been raised to my office, and quite probably maybe John's and other offices over the years, relative to the safety for the Washington State Ferry System. As people know, 18 million passengers each year and 66,000 a day, depend on the ferries for safe, reliable transportation and I was wondering if there were safety questions that should be looked at. Three questions specifically have been raised and we have called this hearing to address those questions. One is, fatigue resulting from the ships and watches that are being utilized by the ferry system. It is possible that fatigue resulting from the current shift scheme could be a safety problem.

The second question concerning the Washington State ferries is should they have fathometers for safety reasons.

And the third question, should there be 100 percent liferafting or life saving capability on the ferries. We have learned that currently that is not the case.

And so we have called this hearing to look at those three questions for the obvious reasons, and with the tremendous number of people that utilize the Washington State ferries, we want to make sure that we are operating them as safely as possible.

We have a distinguished list of witnesses today that have agreed to take their time to come and talk to us about these three questions. We will be calling witnesses in a moment.

I would like first to call on John Miller for any opening statement he has.

STATEMENT OF HON. JOHN R. MILLER, A U.S. REPRESENTATIVE FROM WASHINGTON

Mr. MILLER. Thank you. I want to commend you, Congressman Lowry, for your initiative here not only in getting this hearing scheduled, but also for your bill that has, I think, crystalized these issues.

We have adjoining districts that include a lot of Puget Sound, and we have plenty of constituents that ride the ferries. Of course, there is nothing like a personal experience to make one feel an issue, and in my case it happened a couple of years ago. I was on a ferry coming back from Eagle Harbor. We were just a couple of hundred yards out. It was a winter morning, and it was sunny and cold. We did not expect any fog that morning, but when the sun hit the cold water fog came up. And suddenly this ferry boat was no longer in sunlight, it was in fog. And suddenly there was a lurching as the boat reversed and people were thrown all over, and I wondered what was going on. I looked out the window and I pressed my nose to the glass. Down below I saw this tugboat, and as I pressed my nose real close to the glass I was able to see the water separating this rather large tug and this ferry boat. And, of course, fast action by the ferry boat skipper avoided that collision.

But it did get me thinking. What would have happened if the skipper had not been so alert, and what if we had crashed? And then as I was thinking, I started looking around to see the survival craft on the boat. Where were they? Did people know where they were? And how many were there? And would we have all fit in life rafts if we had to go into the water? Would we have been picked up?

I realized we have a ferry system that has an excellent record in terms of avoiding this kind of near accident, that I described. I also know that many of the regulations that are in place date back to the late 1940's, I also know the ferry system has grown in size of boats, and the number of passengers, and we have learned a lot more about survival in cold water. I think it is time that we do look at this issue.

And, Mr. Chairman, I think we have got a fantastic array of witnesses from all conceivable viewpoints, and I am looking forward to learning a lot this afternoon. Thank you.

[The statement of Mr. Miller follows:]

STATEMENT OF HON. JOHN MILLER, A U.S. REPRESENTATIVE FROM WASHINGTON

I too want to begin by thanking Chairman Hutto for allowing us to hold this hearing.

As I recall Congressman Lowry and I started work on another vessel safety bill in this same hearing room about two years ago. The topic of that hearing was fishing vessel safety. After that hearing we introduced a bill setting out the minimum safety equipment a fishing vessel should have. These included survival suits, electronic beacons, stability surveys and life rafts. The House Merchant Marine and

Fisheries Committee is getting ready to present our work to the House of Representatives early next month.

Coming here today to discuss ferry safety is very timely. We just had our first summer weekend and the ferries are getting ready for the summer tourist rush. Last year, 18 million people rode on Washington State ferries. They are an important mode of public transportation and a unique tourist attraction.

The ferry system is an agency of State government, But the rules and regulations that govern their safety standards are developed by the U.S. Coast Guard. Our purpose is to make sure that these rules are serving our constitutents.

The ferry system has an excellent safety record. But that record, like all safety records, is a reflection on past accomplishments, not a prediction of future success. We will hear from the Coast Guard, the State ferry system and others about the chances for an accident and the safety precautions being required to save lives.

A couple of years ago, I witnessed a near accident while riding a ferry between Bainbridge Island and downtown Seattle. It was foggy, and out of my window I saw a tug boat come within a couple of yards of hitting the ferry boat I was riding. The accident was avoided by some fast thinking by the skippers of both the ferry and the tug and a little bit of luck.

As I reflect on that event and this hearing, a number of questions come to mind. Had we collided, would I know what to do or where to go? Would the crew be prepared to assist me? If I were to get into those cold waters of Puget Sound, could I have found a life raft? Would I have been picked up?

Mr. Chairman, these questions reflect on two of the three topics of our hearing today. First, does the Coast Guard currently require the ferry system to have enough life rafts on each ferry? Congressman Lowry has introduced H.R. 4518, which sets a date for the Coast Guard to implement rules for life rafts. Our witnesses should be helpful in clarifying questions about crew requirements, costs, and the best available technologies. I am sympathetic to the objectives of this bill and look forward to learning more about it from our witnesses.

We learned in our hearings on fishing vessel safety that survival time in waters as cold as Puget Sound is also a function of prompt rescue. I hope that we will move beyond simply talking about how many life rafts are needed and expand our discussion to cover rescue plans to save people.

Second, as I said, the incident, I witnessed was not an accident because of quick thinking. Yet, we have learned that crew schedules may result in chronic and potentially dangerous fatigue. I wonder what might have happened had the skipper of the ferry and the tug taken an extra five seconds to react?

Congressman Lowry and I joined in writing the Coast Guard, asking them to look into how schedules may relate to crew performance. The Coast Guard, I understand, is prepared to present us with some of their findings today. I hope they continue to monitor how scheduling crews relates to the safe operations of the ferry boats.

Finally, Mr. Chairman, we are here to look into the need for fathometers on ferry boats operating inside Puget Sound. The committee has learned that while fathometers are required by the Coast Guard, the ferry system has been granted an exemption by the Coast Guard. We want to know why this exemption has been granted and how it relates to the safe operations of the ferry system.

Mr. Chairman, I have been concerned about ferry boat safety for about six years. Back then, I was a commentator on KIRO TV and radio. I devoted some time to looking into ferry boat safety. One of the people I relied on to help me understand ferry boat safety was Professor Edward Wenk. He is testfying today and I want to commend him for his fine study, "Improving Maritime Traffic Safety on Puget Sound Waterways." I believe that we have a lot to learn about safety here today and look forward to hearing from all of our witnesses. And, I look forward to working with you to develop whatever legislation is necessary to address the problems we will hear about today.

Thank you.

Mr. LOWRY. Thank you, John. Thank you for your continued work on this and other issues.

Our first panel is the Coast Guard, who we in the committee really look to as they are experts and our advisors on safety. We think they do a tremendous job. Our first panel today is Captain Anderson, Chief Marine Safety Divsion, 13th Coast Guard District.

Thank you, Captain Anderson, for joining us. You can proceed ahead with your testimony, please, and I know you are familiar with the questions that we have raised.

STATEMENT OF CAPT. D.A. ANDERSON, CHIEF, MARINE SAFETY DIVISION, 13TH COAST GUARD DISTRICT

Captain ANDERSON. Thank you, Mr. Chairman. I have a brief statement I would like to read.

Mr. LOWRY. I do not think that is being picked up. We always have these problems.

Captain ANDERSON. I am pleased to have this opportunity to testify before the subcommittee concerning the issues relative to the ferry vessel safety of Puget Sound. The issues which we are going to address my remarks are for the adequacy of life saving equipment, and absence of fathometers, on Washington State ferries.

At your request, the Coast Guard recently conducted an inquiry into the incidence of fatigue among Washington State ferry personnel and evaluated its impact upon the safe operation of these vessels. The inquiry's review of the current operating schedules for licensed deck individuals showed compliance with governing laws and regulations pertinent to work hours and crew rest. The vessels are manned as required by their Coast Guard issued certificates of inspection. A review of casualty reports involving Washington State ferries does not support a conclusion that crewmember fatigue has significantly affected the operation of the vessels.

However, it does appear that the current work schedules could result in some degree of fatigue in certain of the vessels' crewmembers. While these personnel appear to be provided with the opportunity to receive rest between work periods, personal habits of some crewmembers have apparently resulted in these periods not being fully utilized for rest. A variety of solutions exist, among them schedule modifications, and it is within the ability of the Washington State ferry system to resolve the problem.

In general on the issue of fatigue, our investigative reports of casualties, do not identify fatigue as a primary or contributing cause in more than one percent of recent merchant vessel casualties. This is not to say the Coast Guard is not concerned with the issue of fatigue. The Coast Guard strongly supported the International Maritime Organization's (IMO) proposal to study fatigue. This issue is now an agenda item for the IMO Subcommittee on standards of training, certification, and watchkeeping. In addition, the Coast Guard recently provided funding to the Marine Board of the National Academy of Sciences to conduct a study of the effect of the smaller crews on maritime safety.

Until the results of these initiatives are presented, and in the absence of other information indicating a need for immediate action, revising the statutes concerning work hours and schedules is premature. If Congress determines that a statutory amendment is necessary to resolve the Washington State ferry situation, the committee should be aware that such an amendment could have significant impact on the operations of all vessels operating on inland waters. For example, most individuals manning a significant portion of the inland fleet, including uninspected towing vessels and fishing vessels, are not currently subject to any shipping laws mandating maximum work hours. Legislation could result in the need for the engagement of additional personnel on these vessels to assure compliance with the law.

Moving to the issue regarding adequacy of lifesaving equipment, the Washington State ferries, and other ferries in similar services, are currently required to carry only a limited number of lifeboats and liferafts. There are not enough of these survival craft to keep all passengers and crew out of the water in case a ferry has to be abandoned. In cold water, this raises the possibility of casualties from the effects of hypothermia. Washington State ferries has recognized a need for improvement, and has voluntarily installed inflatable buoyant apparatus, increasing the lifesaving capacity on most ferries by 90 to 180 persons. This is a good step, but we think more is necessary.

The status proposed in H.R. 4518 would require liferafts for all persons on board ferries operating in Puget Sound. The Coast Guard agrees that improvements are needed in the lifesaving systems on passenger vessels operating in colder waters. In considering appropriate revisions to the lifesaving regulation, we have weighed not only the risk of hypothermia, and the large number of persons at risk in a serious accident, but also the operating record of the Washington State ferry system. Their safety records in terms of lives lost is outstanding, with no recorded fatalities from accidents over the last 30 years. These ferries are normally not far from some type of safe refuge such as shore or shallow water, so there is a good chance that a damaged ferry could be grounded before it sinks. The heavy marine traffic in Puget Sound means other vessels could come quickly to the aid of a stricken ferry.

On the other hand, we know that fatalities would surely mount quickly in the cold waters of Puget Sound if passengers were forced to go overboard in their lifejackets, even if only for a brief period of time. We also know that the recovery of several hundred people in the water could quickly overwhelm the rescue capabilities of any vessels which could be on-scene in a short period of time. For these reasons, we believe that the Washington State ferries should have the capabilities to accommodate their passengers and crew in survival craft. The recent development and approval of inflatable buoyant apparatus make such a requirement a practical possibility.

We are currently developing a notice of proposed rulemaking which will propose a significant upgrading of the lifesaving and survival systems on large commercial vessels of all types, including ferries operating in Puget Sound based on the recent amendments to the international convention on safety of life at sea [SOLAS]. We have adequate statutory authority now for such rules under 46 U.S.C. 3306.

We have already initiated action to see that the capacity of the lifesaving equipment on those ferries operating on international voyages to Canada is upgraded to be consistent with the SOLAS standards. We intend to work with the Washington State ferry system in developing a plan aimed at an ultimate survival craft capacity of 110 percent of the persons allowed on these vessels.

In summation of the lifesaving issue, we agree with the general intent of H.R. 4518, but we presently have the statutory authority we need to adopt rules which would accomplish the same purpose. The process is underway. The rulemaking procedure will allow us to take into account the comments of all interested parties, and to develop appropriate final rules. The present authority allows us

the flexibility to consider other lifesaving equipment such as inflatable buoyant apparatus, to accomplish the purpose, rather than being limited to liferafts as H.R. 4518 would do. Therefore, H.R. 4518 is overly restrictive and unnecessary.

On the issue of fathometers, Title 33, Code of Federal Regulations, Part 164 (33 CFR 164) requires certain navigation equipment on vessels of 1600 gross tons or more to ensure these vessels are porperly equipped to safely navigate worldwide under a broad range of conditions. Specifically, 33 CFR 164.35(H) requires these vessels to have echo depth sounding devices, also known as fathometers. However, as provided for under 33 CFR 164.55, the captain of the port in Seattle has granted deviations from the echo depth sounder requirement to the Washington State ferries. These deviations are based on the limited geographic scope of operation of these ferries, the familiarity of the crews with the operating areas, and the effective aids to navigation system (including Puget Sound vessel traffic service). Considering these factors, and a review of casualty information for the Washington State ferries, the deviations granted by the captain of the port are appropriate.

Mr. Chairman, this concludes my statement. I would be glad to answer any questions that you or the members of the subcommittee may have.

Mr. LOWRY. Thank you, Captain, for your very helpful testimony, and we thank the Coast Guard for responding to the three questions that we have previously asked.

Moving to the lifesaving equipment question, as I understood, as I heard what you were saying, the Coast Guard does believe that 110 percent capability for inflatable buoyant apparatuses of some sort would be a necessary thing, and they are working on regulations to accomplish that.

Captain ANDERSON. That is correct.

Mr. LOWRY. We had raised a question about the cost of personnel to man that lifesaving equipment when we introduced our legislation, and I think we referred to liferaft or a lifeboat, and the question was then raised, well, the additional personnel for the ferry system to man that equipment would be a lot, and it was a very, very high figure, a figure I read in the newspaper. I think it was $95 million, which would be a significant amount to the ferry system.

It had been my understanding that in discussions between our committee staff and the Coast Guard previously, that the Coast Guard did not think that the regulations that would be written would require additional manning. Is that correct?

Captain ANDERSON. That is correct. I do not know if we can say that does not require any additional manning. The regulations that we are proposing would allow the flexibility for engineering design, innovative devices to suffice. For instance, if one crewmember could attend to marshalling half a dozen liferafts, we would only require one rather than six. So we could reduce the number of personnel based on the innovations and ideas, and good engineering, a well planned out survival plan. But I do not know if we could say exactly what that total would be.

Mr. LOWRY. Do you envision that during the development of regulations you would be working with the Washington State ferry

system, and working out what would be the most practical way to accomplish this goal?

Captain ANDERSON. Yes, sir, we are sure we have that flexibility, and we would work with every ferry system across the nation.

Mr. LOWRY. Secondly, as you know, in 1984 in the Coast Guard Authorization Act, there was written a requirement for the Coast Guard—directing the Coast Guard to develop regulations to address this problem that we are talking about, lifesaving capability on the Washington State ferry system.

I, for one, know how absolutely overworked the Coast Guard is, and I also think you are underfunded, and you have a tremendous responsibility. So I am not here to pick on you for the fact that it was 1984, and say "how come we do not have the regulations written?"

But I do want to ask when would you envision having the regulations written to address the lifesaving equipment need on the ferry system, and what timeframe?

Captain ANDERSON. Well, I hope I have the answer for you. We are virtually done with the regulations in-house. We start the internal procedure next week. That should go very rapidly. Then it has to be cleared by the Department, and OMB. We are targeting mid-September for publishing the regulation.

Mr. LOWRY. Mid-September? Very good.

Does the British Columbia provincial ferry system have 100 percent lifesaving capability requirement?

Captain ANDERSON. Yes, they do.

Mr. LOWRY. Are they looking at going above that?

Captain ANDERSON. I do not know, sir.

Mr. LOWRY. But you do know that they have 100 percent requirement now. And then you mentioned that in our treaties for vessel traffic that goes between countries, that it is a requirement now?

Captain ANDERSON. Yes, sir.

Mr. LOWRY. Now, one last question. Referring to the fatigue question, you have mentioned in your opening—in your testimony, that a subcommittee was studying this question, and I missed that. Are you through studying the question of fatigue related to safety, or do you see more happening in the study?

Captain ANDERSON. I mentioned the IMO study, that the schedule be done in February 1989.

Mr. LOWRY. IMO is?

Captain ANDERSON. International Maritime Organization.

Mr. LOWRY. And they are doing a study now on fatigue related to safety?

Captain ANDERSON. Yes, sir.

Mr. LOWRY. And once that study is completed you expect the Coast Guard will again then look at this question, or what happens from here on?

Captain ANDERSON. Well, we hope we will be better educated. Also the National Academy of Science study I mentioned which just started this spring. That is scheduled to be done by the end of the year. That is also pertinent to crew reductions.

Mr. LOWRY. You anticipate the Coast Guard at that time with that additional information will continue to look at this question?

Captain ANDERSON. Yes, sir.

Mr. LOWRY. Yes, Mr. Miller.

Mr. MILLER. Captain, so much of this discussion seems to evolve around what type of survival craft you are talking about. Could you go over the types of survival craft that are available now with the present state-of-the-art? And what kind of survival craft you are talking about in terms of meeting the needs of 110 percent?

Captain ANDERSON. Yes, sir. We have lifeboats, and these are the traditional boats that you see in movies, et cetera. The appliances that we are talking about with the ferries are inflatable liferafts which allowed under the regulations to be substituted for boats. These are stored in fiberglass containers. When they are needed they are either launched by gravity over the side, or they are thrown over the side physically. They have sealed bottles inside which inflate the raft. It has sizes that are varying, varying sizes up to 25 person capacity. It has a canopy over the top. It has food and water inside for people to survive at sea for a certain length of time before rescue.

The other device I mentioned is the inflatable buoyant apparatus. These are similar types of fiberglass containers, inflatable device. Resembles perhaps a large air mattress with a large buoyant ring around the outside of it, and a floor on the inside. No canopy over the top. It can be boarded on any side. They are much larger craft. Normally 45 person capacity. The rafts are 25.

The other device that was mentioned was a DAVIT launched liferaft. If the embarkation desks are too high then the people have to be put in the survival craft, and lowered into the water. And these are inflatable devices that are just lowered over the side with a DAVIT or a crane device.

Mr. MILLER. As you describe those devices, it is clear that depending on which device you choose, you need more or less crew to operate it. You mentioned that some automatically go over the side through the force of gravity.

Captain ANDERSON. That is correct.

Mr. MILLER. So in that case you do not need large numbers of additional crew.

Captain ANDERSON. Not for the launching; however, these rafts still have to be gathered at the embarkation points, and people assisted into the rafts.

Mr. MILLER. What role do passengers play?

Captain ANDERSON. Depending upon their abilities, they could certainly volunteer their services to responsible lifeboat men and officers to assist in helping the probably weaker people into the rafts.

Mr. MILLER. Would they need prior training and drills?

Captain ANDERSON. In order to be competent in being in charge of a liferaft I think they do need training, and they do need drills in order to assist a competent person. They would be working under pressure. I think under close supervision they could probably be very helpful.

Mr. MILLER. Now, you have given this a lot of thought, and in your statement you mentioned the excellent safety record that the state ferry system has, and yet you come to the conclusion that there is a need for more survival craft. Now, there might not be a need for substantial increase in survival craft. I am talking about

110 percent capacity. I am talking about fatalities that might occur in an accident.

What sort of analysis did you do? Did you look into the statistical chances of such an accident? Exactly how did you reach your decision that there ought to be survival craft for 110 percent of the passengers?

Captain ANDERSON. This is basically written by the International Safety of Life at Sea Convention. We are, of course, a full member to that international convention. The main considerations are the water. That is, survival systems in very cold water.

Mr. MILLER. You mentioned the regulations that you are in the process of drawing up, and I might ask when are they going to be ready? Presently there are regulations in effect, right? When were those regulations done?

Captain ANDERSON. I am not sure of the exact date. I heard the late 1940's, and I think that is probably accurate.

Mr. MILLER. These regulations date back to the late 1940's.

Captain ANDERSON. Well, I do not know the exact date, but it sounds like it to me.

Mr. MILLER. Now, in answering Congressman Lowry's question, you said in September the rulemaking process would get underway. Was that——

Captain ANDERSON. No, mid-September to publish the notice of proposed rulemaking.

Mr. MILLER. When would the process end, sir, and when would the regulations be in effect?

Captain ANDERSON. Well, depending upon the comment period, and whether or not public hearings will be necessary, and then drafting the final rule, it would be hard to estimate exactly how long it takes. A period of months to be sure.

Mr. MILLER. Months after drafting?

Captain ANDERSON. Yes.

Mr. LOWRY. Thank you, Captain, very much, and thank the Coast Guard specifically for responding to those questions that have been raised. Thank you very much.

Now, the next panel is Admiral Harold Parker, Assistant Secretary of Transportation, Marine Division, Washington State Ferries.

Admiral, thank you for joining us today, and I assume you will introduce the members of your staff with you for the official reporter here. Please proceed ahead with your testimony.

STATEMENT OF ADM. HAROLD W. PARKER, ASSISTANT SECRETARY OF TRANSPORTATION, MARINE DIVISION, WASHINGTON STATE FERRIES; ACCOMPANIED BY CAPT. JOHN DE CARTERET, RETIRED COAST GUARD OFFICER; AND PHILIP SPAULDING, NAVAL ARCHITECT

Admiral PARKER. Thank you, Mr. Chairman. Good afternoon.

For the record, I am Harold Parker, Assistant Secretary of Transportation, Marine Division, State of Washington. There are present with me this afternoon three witnesses who have also submitted statements. They are Mr. Philip Spaulding, registered Naval architect from Seattle; Captain John De Carteret, retired

Coast Guard officer, and Mr. Armand Tiberero, Director of Ferry Vessel Operations.

We thank you for this opportunity to appear before your committee, and testify on this subject of such importance to the people of Washington.

This afternoon I will briefly summarize our testimony on safety practices throughout the state ferry fleet with particular focus on three issues that have been questioned. Safety is a major concern of the ferry system, Mr. Chairman, and each issue has been addressed in the testimony that I submitted for the record last week.

First, are there sufficient liferafts on Washington State ferries? Of course, this begs the questions what will adding rafts accomplish, how much it will cost, is it cost-effective, is there another way? We feel there are other ways, because in 37 years we have never needed the rafts to abandon ship, there are adequate safety regulations in place, the ferry is its own best lifeboat, and the need has not been shown by any facts.

Second, should Washington State ferries carry fathometers? We think not because our ferries do not explore unknown waters, the masters know their routes, the propellers at each end cause turbulence and technical problems, and the Coast Guard concurs.

And does the watch rotation schedule affect the health, sleep, and appetite and certain other bodily functions of the crews. We feel this problem has been solved because the schedules were changed last October, there is sufficient time off for adequate rest, and the study director, Dr. Sparks sees significant improvement.

This hearing is being held to take testimony on the need for more rafts to correct a reported serious safety problem. I do not agree that any serious problem has been established with our safety, and Washington State ferries has an outstanding safety record due to crew skill, good engineering design, and compliance with excellent Coast Guard regulations currently in effect.

H.R. 4518 would require the Coast Guard to issue regulations for each Washington ferry vessel over 1300 gross tons to be equipped with liferafts with sufficient capacity to accommodate all passengers and employees on such vessels. Taken on the surface, it seems like a good idea. If a ferry loaded to maximum capacity with passengers is sinking, and no help is nearby, then certainly there must be liferafts for everyone or some people will drown. This is a highly emotional issue, and so it is much easier to frighten people into believing they may drown in the dark, cold water without a raft, than it is to assure them the boat they are on is safe.

The Coast Guard regulations presently require certain U.S. vessels carrying passengers to have 100 percent liferaft capability. Among vessels that fit this category are ocean liners and cruise ships. But ocean liners and cruise ships go to sea, and consequently can be hundreds of miles from land or even another ship. Washington State ferries never get more than two and a half miles from the beach and there are always other ships underway in Puget Sound.

If you should ask me do I think a ferry boat can sink, my answer is yes, I do. Anything that can float can be made to sink. In the case of a ferry, just overcome the buoyancy. If you ask me do I think that a ferry will sink, my answer is no, I do not. There are

enough safety features in place to prevent it. There were a couple of articles in the newspaper last February that reported the ferry system shares the state's inland waters with more than 200,000 vessels each year.

I had my operation staff query the Coast Guard Vessel Traffic System Office to verify the information. This is what we learned.

In 1987 there were 212,853 vessel movements in Puget Sound and adjacent waters. Of these, 55,840 were tankers, freighters, tugboats, and miscellaneous craft. The remaining 157,013 vessel movements on Puget Sound were made by Washington State ferry boats. This would lead one to the conclusion that the biggest threat we face is running into ourselves.

And as far as shipboard fires go, there is little on the ferries that will burn. This is by design, not chance. Years ago ships were made of wood, we are not sailing any of those anymore. But if fire should occur, we are ready for it with sprinklers, CO_2 smothering, firewall insulation, et cetera. And we regularly send our crews to the state firefighting school in North Bend.

And with grounding, you are already on the bottom in shallow water, so sinking is not a concern.

In the material before you, Mr. Chairman, is a photograph of a B.C. ferry that was hit by a Russian freighter in Active Pass in the early 1970's. This ferry, like our big ones, has two compartment subdivision. Even if the Russian's bow had penetrated two adjacent watertight compartments, the ferry would not sink.

On Puget Sound our route schedules generally have the two boats leaving each terminal at the same time and meeting in the middle, so a sister ferry is usually pretty close. There are a couple of exceptions to this.

In an emergency other ferries would depart their scheduled runs and proceed to assist. I do not have to discuss the Seattle Coast Guard Search and Rescue system because you are both aware of their capabilities. And if you struck an arc with a ten mile radius from the downtown Seattle fire dock, you would intersect four of our busiest ferry routes. The Seattle Fire Department is also on duty 24 hours a day.

Now, in testimony up to now I have been telling the committee why I think 100 percent rafting is not necessary on ferries operating on Puget Sound. If I have not convinced you, and changes are directed, of course, Washington State ferries shall abide by the laws and regulations just as we always have.

H.R. 4518 is silent on the manning and funding issue, and I could not hear Captain Anderson too well, but I believe the Coast Guard statement that he just made was silent on it too. Both referred to new Coast Guard regulations requiring additional rafting. But what will the new regulations say? No more crew required, one crewman for each liferaft required, as per current regulations, or something in between? This will cost; the only question is how much? We have to know, manpower costs money.

We are not a private business. We are a state agency, and the Washington taxpayers pay our bills. There have been some assurances from the Coast Guard that the manning requirement will be less stringent than at present. But, Mr. Chairman, I have to tell

you those assurances did not come until after you announced these hearings, and then we got those assurances.

Since the personal cost alone under the current rules, 46 CFR, would be an additional $100 million a year, this advanced word was heartening, but depending on the price tag for these new regulations we may be directed to change the way we do business, such as curtailing the number of ferry runs, raising fares, or asking the state legislature to increase our tax subsidy. None of the alternatives, of course, would be the least bit popular.

When it was first announced these hearings were being held there was a flood of local media coverage dutifully reporting such unsubstantiated scare statements as, hundreds will die, handicapped persons will be dead meat, and our ferry boats are death traps. That is right out of the paper. This was a totally unwarranted indictment of a ferry system with an enviable safety record going back 37 years without an accident resulting in a single death or serious injury. All those, while safely transporting over 429 million people across the water.

And that is why I welcome your hearing today, Mr. Chairman, and thank you for calling them. This is the proper time to set aside the theatrics and the rhetoric, and to get the facts and statistics separated from personal opinions and hyperbole. There have been suggestions lately that the Washington State ferry system does not measure up to the standards of safety that it should. To this I say "poppycock". The ferry system meets and excels all Federal regulations of commendations for safety, and our record proves it.

Maybe some Coast Guard regulations have not been changed since the 1940's, but in the 1940's when returning from sea we left the to red buoys to the right, and when you got to the street corner a red light meant stop your car. Some regulations do not necessarily have to be changed.

Another concern of your committee, Mr. Chairman, is fathometers, or depth sounders. This matter was the subject of a hearing before the Washington State Senate Transportation Committee just last year. After taking testimony, the Senate Committee unanimously rejected the proposal. In a few instances when a ferry grounding did occur, the Coast Guard's detailed investigation has shown consistently that depth recording devices would not have been a factor.

And finally moving to the crew fatigue issue, Mr. Chairman. In 1982, Washington State ferries was ordered by the State Transportation Commission to reduce ferry service and cut expenses in order to balance the budget. This action resulted in reducing ferry crews, and that resulted in rotating shifts.

As a result of a negotiated agreement with the Masters, Mates and Pilots Union, Dr. Patricia Sparks, a consultant in occupational medicine, conducted a review of work schedules to determine the impact on productivity, efficiency, health, and safety. Within the guidelines presented by Dr. Sparks we revised the Seattle-Bremgaton work schedules in October of 1987. We recognized our responsibility. We also expect our crews to recognize theirs and exercise good judgment in deciding their activities during their time off.

Mr. Chairman, that concludes my oral testimony. In the material submitted to your committee last week, there is much more infor-

mation on these issues that I was able to cover in such a brief presentation. I hope what was submitted, and what was said here today, has convinced you that we take our responsibilities seriously at the Washington State ferries. We have a responsibility for safety system wide, and we also have a responsibility to manage the system, and to provide acceptable levels of cross Sound ferry service at a reasonable price to our passengers. We take all of our responsibilities seriously.

Mr. Chairman, the public safety question is not a simple dualism, like "black or white", or "wrong or right". Some people are in favor of 100 percent rafting; others feel there is a more cost-effective better way to achieve the same goal.

So, being "pro raft" or "anti raft" should not equate to "pro safety" or "anti safety." We are all here to promote public safety. The only difference is what is the best way, or what is the most cost-effective way. That, of course, is up to you to determine.

Thank you for your attention and your indulgence, Mr. Chairman, and Congressman Miller. We are ready for your questions.

[The statement of Admiral Parker may be found at end of hearing.]

Mr. LOWRY. Thank you, Admiral Parker, for your testimony, and I would like to ask that the testimony of the other gentlemen at the table be submitted in the record.

Now, you know from listening to Congressman Miller and myself that we certainly look to the Coast Guard and rely on them for safety information. If you recall I have acknowledged that, on safety in general, WSF essentially does the job for us. I also agreed with what you said with regard to manning I did not mean a requirement of additonal crew was necessarily. We agreed with what you said. Looking foward, and looking at the discussions on the fatigue question, and the watches, and schedule question I want to work with you to resolve those problems. But, we thought it was necessary for 100 percent inflatable buoyant apparatus capability on the ferries. Now, that is also what the Coast Guard has testified to.

Also, as you know, I kind of fell off my chair when I saw that you claimed liferafts were going to cost $95 million. I know you commented about that being one heck of a lot of money within the Washington ferry system budget.

But our conversations with the Coast Guard led us to believe that the figure upon which the statement had been made in the newspapers, $95 million, was based on 110 percent management requirement, and in the development of the regulation and the hearing process, the Coast Guard does not anticipate that would be the situation, and it would be worked out.

So, over the months, and the hearing process, and the meeting process, it will be very possible to work out what, if any, the additional costs would be. At the least, the ferry system will be required to have 100 percent inflatable buoyant apparatus capability. The international treaty does, and the Coast Guard has said that they think it is a necessary thing. It just seems to me, that it makes a lot of sense what with the moving ahead with the regulations as the the Coast Guard is now planning on doing. And of

course, on the last part I would be very interested in your comments.

Admiral PARKER. There was a lot of question rolled up into one, Mr. Chairman. I will try my best.

The first thing I would like to say is that I have not always agreed with the tact the Coast Guard started off taking, even when I was on active duty. Although once they took it, I marched to that drummer. And, of course, once whatever they come up with is cast in concrete, Washington State ferry system will obey. No doubt about that.

But even lately I have not agreed with everything the Coast Guard has done. I did not agree with the idea of going over to the Persian Gulf with lightly armed cutters. I do not think that was a good idea. The zero tolerance drug thing on the high seas. I was kind of weak on that one too.

Mr. LOWRY. You are certainly peaking on the weak points. [Laughter.]

Admiral PARKER. So, Mr. Chairman, the Coast Guard can change their mind. And I have high hopes they will change their minds when they get down to the proposed rulemaking sessions, and begin to get into that tremendous amount of testimony that was submitted by this panel. I am sure you and your staff are going to have to read it too. I do not envy you that job.

I have always agreed with the Coast Guard once what they say becomes regulations. We will fall in line. We are only obligated to obey regulations, not necessarily to like them. With B.C. ferries, I think, you are almost comparing apples and oranges. I know they are both boats, but B.C. ferries are more of an excursion vessel. Ours are more commuter boats, and we run back and forth across Puget Sound on well established routes. We do not go up in the fjords, and up to Prince Rupert, and places like that, where there are no communities around really of any size once you get past Vancouver.

The Canadian crew configuration is different up there. They have something like 35, while we carry, even on bigger boats, 14 people. And as I mentioned before, the crew equates to money, so we have to ask ourselves do we really need them. Does only being two and a half miles from a beach come to bear here? I have to say yes. If anything should happen to one of these boats, can the captain run the boat aground? Yes, and these things must be considered. There is a difference between B.C. ferries and the Washington State ferry.

Mr. LOWRY. I just wanted to say, Admiral, I think your discussions about the ferry systems should be with the Coast Guard over the development of this question. I foresee a lot of accommodation, and a way to work these things out. I think the attitude is very good by both the ferry system and the Coast Guard in working out this problem.

Admiral PARKER. I received a letter from Admiral Sipes, at Coast Guard Headquarters, and he indicated that someone from the Coast Guard staff would be coming down to discuss this with me and my staff. We look forward to that.

Mr. LOWRY. Mr. Miller?

Mr. MILLER. Just so I understand what I've heard, the Coast Guard says they need 110 percent survival craft, and you are saying that the facts are that there are no facts that show these regulations were adequate. So is it fair to say there is a direct disagreement?

Admiral PARKER. Yes, I think that's very fair.

Mr. MILLER. Now, the Coast Guard talked about SOLAS standards. Goes over the wide—well, I do not think those standards apply to our state's ferries.

Admiral PARKER. May I ask you to direct that to Captain DeCarteret, who was involved in regulation writing for the Coast Guard.

Mr. Miller. Sure.

Captain DECARTERET. The SOLAS convention was developed under the auspices of the IMO for what used to be called the IMCO, International Maritime Consultant Organization, and the convention to those vessels that sail on the high seas. They do not apply to vessels staying strictly on inland waters in any country. And the only vessel that they would be applicable to in the Washington State ferry system is the vessel that goes to Canada. Those vessels usually are given exemptions, and have been given exemptions. And who knows on the East Coast—if you went strictly by the SOLAS regulations you would have to require 100 percent lifeboat, plus 25 percent liferaft. Sea sails with 125 percent liferaft from Nova Scotia down to Boston somewhere.

Mr. MILLER. There is something I do not understand. You or the Admiral, or the Admiral could have lied to me, if a ferry and a big ship collide on the high seas, say the SOLAS standards should apply, right? You are sitting out there and the SOLAS standards should apply in order to get 110 percent capacity, is that correct?

Captain DECARTERET. Yes, 125 percent.

Mr. MILLER. You say that because the ferry could sink out there in the high seas?

Captain DECARTERET. Yes, possibly.

Mr. MILLER. What I cannot grasp is this. I understand that in Puget Sound the waves are not as high. I understand that various points are closer to shore. I understand that there are nearby communities and nearby boats. It seems to me if it is the dead of winter, fog is there, you are out in the middle of Puget Sound, and these boats collide, it is not going to be much solace to the ferry riders to be told that they are sinking in the middle of Puget Sound instead of the high seas.

Admiral PARKER. May I respond?

Mr. MILLER. Sure.

Admiral PARKER. That is an interesting question. It is going to be said, that the shipping has changed, ships are bigger, ships are faster, and there is more risk of collision and so forth. In Puget Sound since the 1940's, 1950's, and 1960's, we now have VTS, vessel traffic systems which takes control of the ships coming through. We have bridge to bridge communications where the captains talk to each other as they are approaching, telling each other how fast they are going, what they are going to do. And we have radars on the boats now. So there are many things in place here to prevent collision.

Now, in addition——

Mr. MILLER. Now, when you talk, Admiral, about the radar, bridge to bridge communications, and all those modern technological devices. That impresses me, but I would be more impressed if I had not had the near accident, if I had not seen those two vessels which I assume had all that radar and bridge equipment. It just missed by a few feet. That tells me that all that modern equipment is not infallible. Is that a wrong conclusion?

Admiral PARKER. If that tugboat had hit the ferry boat it would have bounced off it. It was not going to do any damage to the ferry boat, not the tugboat.

Mr. MILLER. Well, that is reassuring. [Laughter.]

Admiral PARKER. Well, there is another part and parcel to this. I have with me here Mr. Phil Spaulding, a registered Naval architect who designed the Jumbos and several other ferries, and the question you asked, was having a collision on the high seas better or worse than having a collision in Puget Sound, and what you feel about sinking. I would like Mr. Spaulding to talk about the sinking.

Mr. SPAULDING. I designed the B.C. ferries and Alaska ferries. I have a little experience with the ferry design, and I have rather strong feelings about this proposed legislation. Incidentally, these vessels are all designed with two compartment subdivisions. If I explain to you what we are talking about you know the water line of a ship—I am sure you know where the water line is, what the water line is, that you know where the main deck is, and you know about an area known as free board, and that area is what is known as reserve buoyancy.

So what you can do, you can so compartmentalize your ship, water tight transfers and bulkheads, so it is like an egg crate. And so you have a collision, and okay, supposing the ship hitting you has got maybe 106 foot beams. Of course, that is—well, it has a point in it, and that is the part where you actually impact the ship. Okay, sir, you hit the ship in the side. If you hit on the bulkhead you could flood two compartments through these cellular compartments, but these compartments are designed in such a way that they are not large enough when they are fully filled to overcome the reserve buoyancy that you have on a ship. So, therefore, the ship is virtually unsinkable.

Now, I made a statement to you that it would take three discreetly directed torpedoes to essentially sink a Washington State ferry. Because of the compartmentalization of the Alaska ferries, they run on the beams—if they hit rocks they will come back. At one time they ripped 137 feet at the bottom. Cut it like a can opener. Came back under its own power. That is because of designing for the modern standards. Now it is always related to the Titanic.

That occurred 76 years ago, and since that time there have been considerable conventions to cover marine safety, and from the *Titanic* situation, we have completely changed the design of ships.

Now, as the bulkheads are carried up there is no head to the bulkhead depth. That is not so on the *Titanic*, and so she had progressive flooding. Water came in and flooded over the tops of the bulkheads until finally she sank; completely unrelated to the way we have a ship's design today.

Now, the *Morro Castle* had a lot of wooden structure and paneling in the passenger areas. Well, I had an investigation report, one of the Senate reports, 184, which described fireproof construction. It became the law of the land, and since that law was put into effect, there has never been a loss of life on an American ship by fire. It was long before the other nations adopted those rules. And just recently the other nations now have adopted the rules through IMO.

Now, an interesting thing when I designed the first B.C. ferries, they were not designed to Coast Guard regulations. They had wooden bulkheads, wooden paddles, wooden doors in them, and they had a sprinkling system which is not nearly as safe as the American idea of design.

Since then, of course, I designed the last five ferries. They are triple deckers, and they do comply with the equipment to the new U.S. Coast Guard regulations.

So what I say is, and I made the statement, that the ferry boats are their own lifeboats.

Mr. MILLER. You are a distinguished Naval architect. Your testimony is most welcome. I appreciate your elaborating on these points. But one last question. The Coast Guard said in its testimony that we were looking forward to working with the Washington State ferries in deciding these regulations. I assume from your testimony that you see your goal in this process as trying to convince the Coast Guard in the course of regulatory design process that the new regulations are not necessary. If your attempt fails you said that you would obey whatever the regulations are. Is that a correct assessment?

Admiral PARKER. I would hope we would be able to do some influencing on the Coast Guard regulations as they are being written. We can disagree without being disagreeable. We want to make our points known to the Coast Guard in case they do not know what they are. They may have something up their sleeve, Congressman Miller, that we do not know about because it has not been that long since we have learned that they are working on regulations.

Mr. MILLER. Had you and they been exchanging information for the last couple of months?

Admiral PARKER. Only since Congressman Lowry announced the hearing.

Mr. MILLER. But in terms of the Coast Guard coming up with their testimony today, and you coming up with your testimony, have you sat down to the table with Captain Anderson and gone over the same data going back and forth in these arguments? That has not happened?

Admiral PARKER. No, but I had a letter from Admiral Sipes, who is the Marine Safety boss. He will be coming down to discuss this. That I believe that Captain Anderson does not have all of the material he needs to come and make a presentation to say that this is what we are talking about. What do I think? I think this is about where they are now. I think that they are far along with the regulations.

Mr. MILLER. Captain Anderson says they are just about finished.

Admiral PARKER. Well, he knows better than I do because I have not talked with those people.

Mr. LOWRY. Thank you very much. I appreciate it.

Admiral PARKER. Thank you for your attention.

Mr. LOWRY. R.P. Burnside, from the Canadian Coast Guard. Now, Mr. Burnside, I thank you very much for taking your time, and for your coming down to sit in on the hearing. We appreciate that, and you testifying just briefly here with us.

STATEMENT OF R.P. BURNSIDE, CANADIAN COAST GUARD

Mr. BURNSIDE. Thank you.

Mr. LOWRY. Now, Mr. Burnside, the British Columbia system does require 100 percent safety devices. Is that correct?

Mr. BURNSIDE. That is correct.

Mr. LOWRY. Would you testify for the committee as to the comparison with the ferry system in British Columbia and the Washington State ferry system?

Mr. BURNSIDE. Well, I can only confirm that it is a regulatory requirement in our system, that every boat be provided with 100 percent coverage. In other words, lifeboats and inflatable liferafts for 100 percent of the complement. That is a regulatory requirement. I do not feel it would be appropriate for me to justify why it is a requirement. It is based on the international requirement stemming from the Safety Conventions.

Mr. LOWRY. And how long has British Columbia had this requirement?

Mr. BURNSIDE. Well, one way or another it has been a requirement at least for as long as I have been in the Canadian Coast Guard Service which is approaching 30 years.

Mr. LOWRY. Is there a concern for Canadian passengers—we would have on our ferry systems?

Mr. BURNSIDE. Well, we would limit our concern to those ferries that operated internationally.

Mr. LOWRY. And that is 100 percent requirement?

Mr. BURNSIDE. Absolutely.

Mr. LOWRY. Well, is the requirement being increased 140 or 145 percent?

Mr. BURNSIDE. That is in the discussion stage at the present time.

Mr. LOWRY. Now, that would be Canadian Coast Guard regulations.

Mr. BURNSIDE. Again, based on the international proposals.

Mr. LOWRY. Thank you. John?

Mr. MILLER. Just one question. We are talking about 100 percent to basically 125 percent. That's 100 percent of what? Is it a typical load? Is it the maximum number of people that can be on the boat, or what?

Mr. BURNSIDE. It is 100 percent of the total complement of the ferry with crew and the passengers combined.

Mr. MILLER. That is the maximum number of passengers that you could take on that B.C. ferry?

Mr. BURNSIDE. That is correct. They have—typically they have four levels of manning, to cater to the different passenger loads,

that might be confronted during the season. So they operate a tiered system, if you will, which gives a varying crew complement, depending on the number of passengers.

Mr. LOWRY. Thank you very much. We appreciate your coming up.

Mr. BURNSIDE. Not at all.

Mr. LOWRY. The next panel is Dr. Wenk, Professor Emeritus of Engineering, Department of Civil Engineering, University of Washington; and Dr. Ralph Pascualy, Medical Director, Pacific Northwest Sleep/Wake Center; and Dr. Patricia Sparks, Consultant in Occupational Medicine.

Dr. Wenk, thank you very much. Nice to see you again. I thank you for joining us, and I do know Dr. Sparks is here. I think she will be coming in to join us after you start. If you would just proceed ahead with your testimony, and thank you.

STATEMENTS OF DR. EDWARD WENK, JR., PROFESSOR EMERITUS OF ENGINEERING, PUBLIC AFFAIRS AND SOCIAL MANAGEMENT OF TECHNOLOGY, DEPARTMENT OF CIVIL ENGINEERING, UNIVERSITY OF WASHINGTON; ACCOMPANIED BY DR. RALPH PASCUALY, MEDICAL DIRECTOR, PACIFIC NORTHWEST SLEEP/WAKE CENTER

Dr. WENK. Thank you very much, Mr. Chairman, and Mr. Miller. It is a real pleasure to be invited to testify here today.

By way of introduction, may I recall that proposals for some sort of liferafts on ferries to accommodate all possible passenger loads were initiated ten years ago, finally presented in report issued six years ago. This event today is a miracle in that it is the first instance of serious consideration of the proposals.

You, Mr. Chairman, deserve an awful lot of credit for tightening the consciousness of need for this arrangement. Some of us have proposed to other members of the Congress and committees in the Senate, that they attack this safety issue at the highest level, but without success.

I have to say that when it was first issued, this report on improving safety in Puget Sound drew some surprise. It was attacked by both the U.S. Coast Guard and the Washington State ferry system. It has not been mentioned before, but in light of comments by representatives of both services today, I believe I should tell you that within a week after that report was issued the Washington State ferry system sent a delegation of four members, at the direction of the Secretary of Transportation, asking me to withdraw that report.

As a professional involved in maritime safety of 40 years, the first question I had to ask was why; was there was a deficiency found in the reports, or errors in data, based on U.S. and Canadian Coast Guard statistics? There was no error in the report, in fact, one of the delegation had not even read it. The reason was simply that it would be upsetting to the ferry passengers.

In, the succeeding two years, attacks continued on the report by both by the ferry system and the U.S. Coast Guard. Therefore, you can see why I support your draft legislation with such enthusiasm.

In the first instance, the study was conducted not because there were high casualty rates, but because we did not know how safe were maritime operations in Puget Sound. Was there a disaster waiting to happen? It has to be said that when we identify any kind of risk—whether it is according to the maritime transportation, or air transportation, or proximity to the power plants—the risk is based on two factors: the first is the probability of an accident, and the second is based on an estimate of the consequences, especially in a situation where the probabilities are very low.

The consequences of a ferry accident are very serious. All of the past data in the world are of no help and I think that needs to be underscored, given the specific assertions that you have heard today with regard to the fact that the ferry system has not had an accident involving a death or a serious injury in the last 50 years. That is commendable, and indeed the skills of the ferry captains have to be recognized. But it has also has to be recognized that this question of accidents depends to some extent on luck. Whether or not you have an incident or accident, whether or not you have a fender bender, or a catastrophe, is to some extent an act of luck as well as skill. Those of us who must survive driving on I–5, have come to recognize how important is luck in collision avoidance.

That report, incidentally, was prepared both because of this lack of any serious study up to that time, and because concerns expressed by the National Transportation Safety Board, after they studied close shaves. The report had ten recommendations. Eight of these were aimed at preventing accidents. Two of these were aimed at mitigating the consequences if indeed the accident was not prevented. These involved provisions of life rafting equipment. The second proposal—I want to underscore this and get back to it briefly—had to with contingency rescue plans.

The point is that risks associated with ferries are unusually high because ferries are obliged to travel in all kinds of weather, across traffic lanes; they make enormous amounts of transits, as mentioned already today. Thus they have higher statistical risk of casualty.

If indeed there were a collision, the issue is not so much whether or not the ferry would or would not sink. I think the greatest hazard is fire. And this may occur from two different sources. First of all, our ferries already carry large amounts of gasoline in the fuel tanks of automobiles. From other accident experiences, it does not take much to puncture those tanks and have their flammable gasoline spreading on the deck, possibly ignited.

It is also possible that a ship in a collision—the other ship in a collision—may be carrying hazardous cargo, and there is no certainty as to what would happen with that cargo in the event of a collision. This is a reason I think it is essential that we find some way of dealing with passengers other than asking them to stay on the vessel.

Assertions by other witnesses of safety because ferries are within two miles of land at all times have to be looked at very carefully. Proximity to land is not the factor that is involved. The question is how swiftly, and in what numbers, rescue vessels could be mustered and mobilized for rescue.

Consider, for example, the San Juan run, late at night, the last ferry, in a fog, in a collision. It would be my guess that it would take two to four hours before you have rescue capacity equal to the number of passengers that might be on board, especially those that might be returning after the jazz festival. They are insufficient in number; completely oversaturating the capacity of the pleasure craft that might be in the vicinity.

The other thing that we have to consider is, of course, the fact that the temperature of the water is so low that lifejackets offer no guarantee of saving lives. Hypothermia would be the hazard.

Other issues were raised in this safety report. My own feeling is that you have opened up a series of issues that deserve continued attention. For example, there is supposedly in place a contingency rescue plan so that you could identify all of the rescue capabilities, the opportunities that you have relating to hospitals for people who are suffering from burns or hypothermia.

So far as I could tell six years ago, that contingency plan was never shown to any of the masters of the vessels. Recent inquiries indicate that even today the masters of the vessels do not have any information on such a contingency plan, and I would strongly urge that some attention be given to this. No one can object to that on the grounds of excessive cost. This is a matter of planning, and a matter of responsibility of the safety authorities.

Finally, I would like to mention some other proposals in that report. This question of ferry safety does not depend only on the question of capabilities of ferry system itself. If you are going to have a collision it is going to be with other vessels; therefore, it is necessary to look at the safety of the entire maritime system. Here we recognize that safety critically depends on the human factor. The question therefore revolves around the competence of and the information available to the person at the wheelhouse. It is there that I think we need to look very carefully not at the ferry system, but at the Coast Guard requirements for competance of mariners who are operating all vessels. Second, we should examine the record of violations and the unsafe practices that have been detected, and the lack of penalties that were imposed. Unless there is a strong police force, in my opinion nothing is going to happen.

There has been some notoriety of Coast Guard practices about the zero tolerance. I would like to suggest that this concept for zero tolerance be applied to vessel safety. Thank you.

[The statement of Dr. Wenk may be found at end of hearing.]

Mr. LOWRY. Thank you, Dr. Wenk, for your testimony, and thank you for your long time work on this subject.

And, Dr. Sparks, we thank you for joining us. If you would care to go ahead with your testimony.

STATEMENT OF DR. PATRICIA J. SPARKS, CONSULTANT IN OCCUPATIONAL MEDICINE

Dr. SPARKS. Thank you. For the record, I am Dr. Patricia Sparks. Actually I was going to show you some slides today, but I was not able to.

Back in 1982 shift schedules changed due to demands of the ridership on the Bremerton run, the work shifts changed three times

in eight day periods with starting times as early as 5 a.m., and finish times as late as 2 a.m. Other runs had less extreme changes, but still had some watches that were undesirable because of the hours of work.

In 1984 my colleague, Dr. Pascualy, had the deck crews on the Bremerton run, keeps three diaries for the week. This showed variable patterns of sleep. In 1986 the DOT contracted with me to perform a literature review and survey of the health effects of shiftwork among the deck officers.

This study is based on a survey of 121 members of International Organizations of Masters Mates and Pilots of the Washington State ferries. I sent out a questionnaire, approximately 77 percent responded to the questionnaire. The questionnaire was adapted from a NIOSH questionnaire designed by Smith, Colligan, and Tasto. It was pretested with 2,000 shift workers nationwide, and contained about 250 questions on the personal habits, lifestyle, job, health, psychological state, and eating habits, and was more than I wanted to know about each worker.

It also—I added some performance questions on falling asleep at work, errors of judgment, falling asleep at the wheel, and auto accidents.

I also obtained total sick days, and that includes loss for personal illness, and work related injury or illness, together. The Comparison groups were other shift workers in the medical literature, and also the Bremerton run.

We got a pretty high response compared with other surveys of 77 percent. We found that demographically that the Bremerton run did not differ significantly from the group as a whole. The average age is 44; they worked 16 years, and only 4 percent were women.

In terms of general health questions, we found that the prevalence of those who have been told by a physician that they have hypertension is somewhat higher than would be expected for a group of average age 44. The average number of sick days on the Bremerton run is significantly higher than the other runs.

We note from the literature that shift workers have increased rates of injuries and increased substance abuse. I found that there was no significant difference in reported alcohol use for workers on the Bremerton run versus on the other runs, but 8 percent of the group uses alcohol to get to sleep. The percentage of smokers is not higher than the other runs.

We note from the literature that the shift workers showed a decreased satisfaction with their jobs—many variables affect satisfaction with the shift work, but the sequences, the frequency and direction of shift changes clearly has an effect on job satisfaction.

I asked about the masters, mates, and pilots social and family life. At least half of the shift workers, and families, were dissatisfied with the schedules, and this has been widely reported in the literature.

Significantly more workers on the Bremerton run were dissatisfied with their schedule. About a third of the shift workers reported that their schedule interfered with time for family and children, outside groups, and hobbies. The divorce rate was slightly higher in the general population of similar age.

Significantly the mean number of hours of sleep per day is 6.2, almost two hours less than the stated ideal and lower than that of day workers in other studies.

The proportion of those feeling tired at work at least two to three days per week is higher than night shift workers studied by NIOSH with the same questionnaire.

Significantly more masters, mates and pilots report difficulty going back to sleep once they wake up. Their sleep pattern in general is poor, and they report that they feel tired at work two to three times per week or more.

Thirty-six percent of the masters, mates, and pilots on the Bremerton run had consulted a physician for insomnia versus 7 percent of the others. Thus, more sleep difficulties are suggested on the Bremerton run.

The study showed that the shift schedules interfere with the social interaction that sharing meals with friends and family affords.

We know from the medical literature that during the night shift the decrease in mental work is greater than the decrease in physical work; decreased vigilance is observed with perceptual isolation or monotonous surroundings. Decreased performance in airline pilots at night has been observed; decreased performance on night shift with dip at 3–4 a.m. has been observed in telephone operators, meter readers, train engineers, and truck drivers.

The survey looked at incidents/performance in the group as a whole. Seven percent have been involved in ferry accidents; 2 percent where fatigue was a factor; 33 percent have had near misses in their current watch; 20 percent where fatigue was a factor; 23 percent report errors of judgment, 20 percent where fatigue was a factor; 43 percent reported falling asleep at work on their current watch, 23 percent as often as once per month. The questionnaire did not differentiate falling asleep at the wheel or in their cabin.

Seven percent have auto accidents due to falling asleep, 42 percent near misses at the wheel of their car due to sleepiness. A significantly greater proportion of masters, mates, and pilots on the Bremerton run report errors of judgment, especially where fatigue was a factor. Significantly more on the Bremerton run report near misses related to fatigue. A greater proportion of Masters Mates & Pilots on the Bremerton run report having had ferry accidents related to fatigue but results are not significant perhaps due to the small numbers of accidents.

The above reports suggest that fatigue due to shiftwork may well be a factor resulting in potentially serious errors of judgment and possibly increasing the risk of ferry accidents.

I appreciate the opportunity to comment on the issues of the shiftwork of the ferry system.

[The statement of Dr. Sparks may be found at end of hearing.]

Mr. LOWRY. Thank you. John?

Mr. MILLER. I have two quick questions. Dr. Wenk, you have been involved with this issue a long time, and I was intrigued by your comment about the main danger from your point of view possibly not being sinking but a fire. Did you in the course of your study review the precautions that are now being taken by the ferries against fire? And if so, what conclusions did you draw?

Dr. WENK. We did not look at—well, that was not within the scope of our study. We were looking primarily at the cause of the accidents, but not the mitigating, damage control measures that would be taken subsequently. So focus of the study did not answer that particular question.

Mr. MILLER. So when you recommended more survival craft, that was based on the assumption that there would be—if there was a fire there would be inadequate survival craft?

Dr. WENK. I think the situation which called our attention to the risk of fire was interviews that we conducted with a number of ferry captains on the U.S. system, and also some on the Canadian ferries. One of those had been involved in a grounding where the ferry listed about 15 to 20 degrees as the tide dropped, in the course of which several of the trucks on board fell over and spilled gasoline. This ferry captain emphasized the tremendous hazard that existed during the time they were getting over 1,000 passengers off. Fortunately without a casualty. So I believe we were sensitized by that particular incident to realize that these things can happen.

Two other points. One, we analyzed the data that are available. Casualties of all kinds were worldwide, and fire turned out to be one of the consequences of an accident primarily as a result of collision, but not always. Some of these fires occur on the ships themselves, not in any proximity to another vessel.

The second point has to do with the emphasis that we put in the study on how to prevent accidents at low cost; and I believe that our recommendations there are pretty strong on that aspect.

Mr. MILLER. One question, Dr. Sparks. In your testimony you refer to the survey of the crewmembers, and the reports of near misses. What is a near miss? Is that some statistic that is collected by the ferry system? Is it just a crew member reporting to you what they thought was a near miss? What does that mean?

Dr. SPARKS. This was a confidential question, on the questionaire survey and these are self reports. I also understand that the crew keeps a log of statistics as well. No attempt was made to corrolate self reports and the log.

Mr. MILLER. Dr. Wenk, do you want to comment on that?

Dr. WENK. The questions about near misses is an important one, and I recall the use of such data to highlight potentially dangerous conditions of aircraft traffic. There is a reporting system that has been in effect now for about eight years, used by the FAA which regulates the safety of aircraft. Reports are made to NASA so as to protect the individuals who are reporting, and who would be apprehensive about being punished because they may indeed have been a source of a near miss.

The point, however, is that near misses are well known by people who operate any kind of vehicles whether again on I–5, or whether a ship in Puget Sound.

The Canadian ferry system requires that all near misses be reported to their headquarters, and they use those data in order to try and reduce the exposure to potential accidents. One of the ten recommendations in the report I referred to earlier was to institute such a near miss reporting system. Interestingly enough, as a result of that recommendation, the Secretary of Transportation,

Elizabeth Dole, in 1985 instituted the system. However, but it was not in the Coast Guard because of objections within the Coast Guard. So it was initiated by the Secretary's office. The system collected seven hundred reports the first year; but was cancelled because of lack of funds.

Mr. MILLER. So there is presently no near miss reporting system in the Washington State ferries?

Dr. WENK. There is none except as it is volunteered, as far as I know.

Mr. MILLER. Who would volunteer to whom?

Dr. WENK. Well, the Coast Guard in their reporting system has a category of near misses.

Mr. MILLER. Volunteered to the Coast Guard?

Dr. WENK. Volunteered to the Coast Guard, yes.

Mr. MILLER. So the Coast Guard has statistics on near misses based on what they have been able to collect?

Dr. WENK. What they have been able to collect, yes.

Mr. MILLER. Are you familiar with those statistics?

Dr. WENK. For the period that we examined them, yes, but after five years I had very few; they were at random, and not subject to any statistical analysis. The system that Secretary Dole put in place was an experimental one where they realized that even the 700 reports that they had the first year could not be subject to statistical analysis because it takes a while before they feel that they have an entire system under some kind of uniform reporting requirements.

Incidentally, the questions that I raised in Puget Sound with regard to that DOT near miss reporting system suggested to me that publicity for it had not reached any of the ferry operators; the only individuals that I found in Puget Sound who knew it was official were officers in yacht clubs; these also were invited to report, but as far as I know received none of the forms.

The system is one where there was an attempt to provide a uniform system for reporting, and these forms supposedly were made available to all mariners.

Mr. MILLER. Thank you.

Mr. LOWRY. Dr. Sparks, about the survey, would you say that there was analysis as to the repeat factor relative to the chances of an accident? Understand, I am not trying to jump too far ahead on the conclusion, but I have heard Dr. Wenk say there is a concern about fire from a collision, or fire even without a collision. Certainly as a result of the collision, not the sinking as much, as pertains to the fire. Obviously I am concerned about it in relationship to the shifts, and fatigue, and to the increased chances of there being a collision. I am not trying to get a conclusion out of you. If that is not what your survey says.

Dr. SPARKS. Well, surveys obviously have multiple limitations. These are soft reports and of incidents we cannot verify. I think that a large percentage of people who report near misses, especially on the run where apparently they perceive the worst problems, would indicate that the fatigue factor is significant. And I would have to say that obviously if you are fatigued your reaction time may well be reduced. That could be critical in some situations.

Mr. LOWRY. Now, in October, that would have been 1987, both you and the ferry system testified that there were new shift rules put in? Can you summarize what those changes were, and how much that would impress any potential problem?

Dr. SPARKS. Yes, I could, but it would probably bore you to go through each of these.

Mr. LOWRY. Well, submit them for the record though.

Dr. SPARKS. Well, I think that the changes, while they are not perfect, are certainly a step in the right direction, and represent a significant change.

Mr. LOWRY. Are there still only six hours off between shifts?

Dr. SPARKS. In this particular run, no. People seem to have adequate time between shifts.

Mr. LOWRY. Are there any other questions?

Mr. MILLER. No.

Mr. LOWRY. Thank you both very, very much, for your very helpful information. Dr. Wenk, you have worked on this a long time.

Dr. WENK. Well, it is a good time to see this being discussed.

Mr. LOWRY. Our next panel is Captain Lynda Wheeler, representative of Masters, Mates & Pilots Union; Captain Tom Jacobs, representative of Masters, Mates & Pilots Union; and Captain Bob Davis, representative of Masters, Mates & Pilots Union, Washington State Ferries.

Thank you very much for joining us, Captain Wheeler. If you will go ahead with your testimony, please.

STATEMENTS OF CAPT. LYNDA WHEELER, REPRESENTATIVE OF MASTER, MATES & PILOTS UNION, MASTER, WASHINGTON STATE FERRY VESSELS; ACCOMPANIED BY CAPT. TOM JACOBS, REPRESENTATIVE OF MASTER, MATES & PILOTS UNION, MASTER, WASHINGTON STATE FERRY VESSELS; CAPT. BOB DAVIS, REPRESENTATIVE OF MASTERS, MATES & PILOTS UNION, MASTER, WASHINGTON STATE FERRY VESSELS

STATEMENT OF CAPTAIN WHEELER

Captain WHEELER. In response to Admiral Parker's expectations, I would like to reiterate that I take all of my responsibilities seriously, so let me begin.

On Friday, April 29 I approached the dispatcher Gerhard Wack stating that I would like to work as captain in the San Juan Island for the summer schedule. (Approximately 20 minutes drive to work.) I will live on North Whidbey Island, as I did last summer, when I worked as captain on the Port Townsend to Whidbey Island run on a ferry built in 1937, with no water tight compartments, and carrying 600 passengers. Three days ago the dispatcher, Gerhard Wack stated that he would like me to work the mate job on the Swing Relief crew with Winslow as home port. Beginning June 19. The schedule for this job reads as follows:

Wednesday; start in Anacortes aboard the *Kittitas*; to work from 3:05 p.m. to 10:05 p.m. Thursday; start in Anacortes aboard the *Kittitas* to work from 6:05 a.m. to 3:05 p.m. Friday; drive to Seattle, two plus hours, catch the ferry to Winslow, 30 plus minutes to start aboard the Walla Walla, or Spokane (it changes every week) to work from 7:00 p.m. to 3:00 a.m. Saturday (peak traffic). Saturday;

sleep aboard during the day on an operating ferry to start work again in Winslow at 10:30 p.m. to 7:10 a.m. Sunday. Sunday; catch ferry to Seattle, 30 plus minutes drive to Fauntleroy, 30 plus minutes, catch ferry to Vashon, 15 plus minutes, to sleep during the day, yet another ferry. Start in Vashon aboard the *Quinault*, to work 4:00 p.m. to 11:20 p.m. Catch ferry back to Fauntleroy, via Southworth, one plus hour, drive home to North Whidbey Island, three plus hours. Home approximately 3:30 Monday morning. Tuesday off.

The direct result of such a schedule is impaired judgment, slowed response time, drowsiness at inappropriate times, excessive nervousness due to increased caffeine intake, and irritability. Almost all the schedules at Washington State Ferries produce these reactions. During this time we have from 800 to 2400 passengers aboard. The few schedules that have more normal hours are those belonging to people of very high seniority. Anyone interested may obtain a copy of this schedule that I just read.

Mr. LOWRY. Thank you. Captain Jacobs.

[The statement of Captain Wheeler may be found at end of hearing.]

STATEMENT OF CAPT. TOM JACOBS

Captain JACOBS. Thank you for inviting me here. It seems like an awful lot of this type of testimony seems to drag, until you hear things like Three Mile Island, or the Space Shuttle catastrophe, where fatigue was so definitely mentioned as a factor. I also heard on the news where President Reagan stopped in Helsinki to recuperate from the effects of jet lag. That is a very legitimate concern.

I have also heard that the accidents that occur really are not much. I would like to review one that did occur. A ferry left downtown here at Pier 52. The captain had been working on some of these rotating schedules. He had expressed concern that he did not feel right, and that he was being affected by it. He went to Winslow, it was late at night, not too many passengers on board, nonetheless people were on board. Arrived at Winslow, no problem. Departed Winslow, walked up to the wheelhouse, looked into the radar, and what he saw who knows. He had seen the same pictures hundreds of times. He told the helmsman to come right to our next course. Helmsman and the chief mate said, "no, we cannot. It is not time yet." And he said, "go hard right." He walked over to the helmsman, pushed him away, put the ferry rudder hard right, and the ferry went aground. There is a propeller on each end. One propeller is stuck in the mud, and another propeller is not in the mud. He decides, okay, I am going to engage the propeller that is stuck in the mud and try to plow our way out of here rather than use the free propeller to drag away. The engine room calls up and says that "it is getting hot down here. You better take it easy." The deck hand calls up and says, "Captain, there is smoke coming out of the vents." The engine room calls up and says "Captain, there is fire in the engine room." Now, there is a clutch fire. I spoke to the engineer on watch at the time. There is about 10,000 gallons of fuel in that space alone. Now, what caused this accident?

The Captain walks up and says "okay, hard right." He puts the ferry aground. It does not make sense. And is it called pilot error, or poor judgment? I think it really is called fatigue due to rotating watches. The jet lag syndrome has been shown to cause these things.

There has been other agencies that have looked into these factors. NASA and NRC, FAA, Police Department, Fire Department, there are a lot of people looking into this because they do not want their people making silly errors. As far as the state ferry system is concerned, the management, I am not sure exactly what their stance is. A group of us went down and spoke before the State Transportation Commission. We may as well have been beating our heads against the wall. Ray Deardorf, one of the schedulers down there, exemplifies this attitude. I saw him approximately two months ago. He had not even yet read the report that detailed all these problems and recommendations to alleviate these difficulties. I found that appalling. And Admiral Parker says, "well, we solved all these problems." I beg to differ with that. I think not. You cannot just say, well, okay, Bremerton run, we looked at it. Had this hearing coming up. We adjusted it. Case closed. No, that was one run out of how many?

There are eight runs between Tacoma and the San Juan Islands. Some of the watch hours are detailed in other testimony that has been sent to you, there are some horrendous work schedules out there. I have been working shiftwork for 15 years now, and I always felt myself pretty resilient and usually able to bounce back. But I am sure if you worked on some of these hours, it would bring you to your knees too.

Thank you.

Mr. LOWRY. Thank you, Captain Jacobs. Now, Captain Davis.

Captain DAVIS. Well, I yell a lot, Congressman, so you may be able to hear me.

STATEMENT OF CAPT. BOB DAVIS

Captain DAVIS. Liferafts or rescue floats. Now, I am honored and grateful to contribute my experience and perceptions to this committee.

I first went to sea in 1943 with the United States Navy. After several Pacific invasions I was honorably discharged and entered the Maritime industry where I earned a First License (N.Y. Harbor Pilot) in 1948.

I have served since, mostly as Master on the waters of New York Harbor, the Great Lakes, most of the major harbors of the East Coast, the Mississipi River, Hawaiian Islands, Columbia River and Puget Sound. For four years I served as Safety Coordinator for the Deck Officers of Washington State Ferries. I am presntly Master of the super-ferry "Yakima."

The rules for liferafts for ferries are separate from the rules that apply to other passenger vessels (Title 46 CFR, Table 75.10–10(b)(1)). These ferry rules stop at 600 tons, period. These rules incredibly require life rafting for 36 persons total even though our vessels carry up to 2500 passengers.

The rules were written more than forty years ago. There have been numerous and dramatic changes in Puget Sound in that time as follows:

1. Forty years ago our ferries were one-third the size. They were slower and they carried on some trips one-tenth the passengers they carry today.

2. The waters of Puget Sound are more congested by far than forty years ago.

The average ship then was 5 to 8 thousand ton and did 8 to 13 knots.

We encounter today ships of 30 to 50 thousand tons, doing in excess of 22 knots and most have a ramlike bulbous bow which increases the chances of hull penetration.

3. The mix of cargo in autos, trucks, and RV's is in most cases uninspected and unknown. There is every reason to believe that we carry today many times the hazardous chemicals and inflammables than forty years ago.

4. And most important, forty years ago our knowledge of the effects of hypothermia was limited.

Today we have medical proof that persons in the cold (47 degrees) waters of Puget Sound for 15 to 30 minutes may not be able to help themselves, meaning they cannot grab a line or a ladder or get themselves up and into a boat or raft. It is imperative that these persons be kept out of the water or they shall begin to die.

So the risk of collision is greater today and the impact and result of such a collision would be more profound. The risk of fire is greater, and the means to control that fire is questionable.

If an unbiased expert could guarantee that ferries cannot sink, we would not be here, or if an unbiased expert could guarantee that if a ferry sank, capsized, or was engulfed in flames, that enough meaningful help would arrive to remove all passengers from the water in 15 to 30 minutes, we would not be here today. We have been told that ferries are practically unsinkable, practically unstoppable. If this were true, we should get a big key, and a big safe, and lock those ferry blueprints up because every Navy of the world would covet those plans.

For many and valid reasons the United States Coast Guard requires that we (the ferry crew) be ready at all times to abandon ship. As an example, let us not take the worst case scenario. Let us take the best case scenario.

Two hundred yards, not two miles, off Coleman Dock, a ferry has an uncontrolled fire, and abandons ship. It is daytime, no wind, no fog, a thousand people are in the water. There are 20 teams of two men each on the launches right at the scene. A miraculous circumstance. Allowing one minute per passenger. It would take an hour to remove all passengers from the water if each team had the strength. Two people, 50 passengers; two people to lift one person from the water can be very, very difficult.

Now, let us put the ferry in the middle of Puget Sound at darkness and fog, and take away the rescue teams and the launches, and fire, and abandon ship. The call goes out, 1,000 people in the water, help comes, but too late, and too little. Hundreds will die.

If this very day the 5:25 p.m. ferry to Winslow were to abandon ship in the middle of Puget Sound, hundreds would die needlessly, for lack of liferafts and timely help.

It is morally indefensible to deny any ferry passenger the chance to survive such an event. Now, I ask you to heed this quotation. "The time to take all measures for ship safety is while still able to do so." Nothing is more dangerous than for a seaman to be bludgeoned into taking precautions unless they turn out to be unnecessary. The safety at sea for thousands of years has depended exactly on the opposite philosophy of Admiral Chester Nimitz.

In 1983, when the ferry captains appealed to the Coast Guard Commandant for more liferafts, we began like this, and I quote. "And by liferafting we mean any flotation device, including inflatable platforms, to keep passengers out of the water that will not require additional crew to launch." The ferry managers have copies of this. The Admiral has copies. He was sent copies of this.

Statements by the ferry management to state that liferafting for all would require 2,900 additional crewmen, that some ferries would require 100 crewmen, and that the annual cost would be $100 million, these statements are absolutely false, and ridiculous, and they are based on artful deceptions. They are talking about deep sea passenger vessel rules that require one certified lifeboatman per raft. We, the captains and the Coast Guard, are talking about simpler, less expensive, rescue platform that does not, or may not, require additional crewmen.

The managers know this, the Coast Guard knows this, the captains know this, but the ferry managers' gross exaggeration of deception have placed doubts in the minds of some. Let me put your mind at ease, the Coast Guard knows what they are doing in this case.

The cost of the raft would be much less than quoted by ferry management. There will be little, if any, extra crew members required. But most important of all, our passengers will be safer.

It is of the utmost significance that this is the first time in maritime history that 52 licensed masters have requested that the United States Coast Guard take specific action to subsequently increase passenger safety. It is of the utmost significance that the licensed masters who are making these recommendations have nothing to gain from the implementation of them, nothing to gain except a greater safety and security of the ferry passengers.

There are no issues of union security. There are no questions about increased pay or responsibility. The licensed masters, there are no political or economic benefits to us of any kind. The licensed masters who have initiated this appeal, and who are determined to pursue it until it is satisfactorily resolved, are motivated only by their professional conscience, their understanding of their duties, and their moral commitment to provide safe passage to those who trust them to do so. The nature of this motivation is significant.

I therefore recommend liferaft capacity for all passengers and crew, and two, a means to place these passengers into the rafts quickly and safely.

Thank you.

[The statement of Captain Davis may be found at end of hearing.]

Mr. LOWRY. Captain Davis, in your experience, without significant additional crew, would there be the capability of getting this lifesaving equipment overboard, or apparatus? I believe you say a liferaft?

Captain DAVIS. Yes.

Mr. LOWRY. Now, could that be done by the passengers and so on, or not?

Captain DAVIS. It is very simple. The ferry system did not particularly care for it, but it was very simple. Just wanted to get the people into the lifejackets, get them mustered on the upper deck, but I was concerned. I was concerned about the attitude, and trust, and competence the passengers would have in the crew. I was concerned for the trust and competence that the passengers would have towards the crew to proceed with instructions and obeying orders.

So we did not really know, and we wanted to know. We wanted to learn about this. So what we did, and we are doing now, is on the busy trips we select two or three passengers in each area, and we ask them if they would like to help in the case of an emergency, and the ones we asked said yes. In fact, they were pleased. So we had these two or three passengers in each section, four to the sections of the passenger area, and we called a drill. The drill went wonderfully well. The passengers acted very cooperatively, and in six minutes we got mustered on the auto deck. The problem then is who is going to get the liferafting capacity? Who is going to get into the liferaft. Am I going to play God and say "you go and you stay." No, I do not want to play God. No ferry skipper wants to play God.

So that became very apparent that, yes, we could muster on the auto deck with the proper cooperation of the passengers. And I might add that this drill really, in my opinion, I know, it created a great feeling among the passengers, and a rapport between the crew and the passengers.

One thing we did, number one, the passengers and the crew, what we learned that the crew meets the passengers because there are too few of us, so we need them, and they are willing to cooperate. They did cooperate gladly.

Now we walk down the street in Kingston and the passengers say "hi, Bob, how is it going? Keep it up. Good. We love it." This is the first time they tried to do something halfway decent for us.

Mr. LOWRY. So this particular safety crew that you are addressing, and other passengers, have the rights of the buoyant apparatus, you think this needs to be met by just the capital acquisition of the apparatus without any extensive extension crew?

Captain DAVIS. Without any extensive. In other words, there may be some vessels that are configured so they have to add maybe one crew member maybe. On some vessels it would require no additional crew member at all, but it will be nothing like $100 million exception.

Mr. LOWRY. It would be the equipment acquisition?

Captain DAVIS. It would be very small.

Mr. LOWRY. Mr. Miller?

Mr. MILLER. Captain, an earlier witness said that with the present design of ships, due to the improvements in design over the

last 40 years, that they are just not going to sink. It would take two torpedoes.

Captain DAVIS. Three.

Mr. MILLER. Three torpedoes.

Captain JACOBS. I would like to say something to that.

Mr. MILLER. I would like to get your response to that because the man that said that is a very distinguished leading Naval architect.

Captain JACOBS. Now, maybe the newer ships, but a lot of those are designed so they have this excellent compartmentization, and they have to take two hits in order for everything to go wrong. But you have to realize a lot of these ships out here they were not made then.

When was the ferry Olympic made? 1937. Running between Port Townsend and Keystone. The waves get really big there. It is on record that that ferry listed over to deck edge immersion and stayed there. I am sure that anybody who realizes what deck edge immersion is knows that that is almost a point of no return. There is also a case of the Evergreen State. I think they were built in 1950's. Now, this was off of San Juan Islands where they were actually taking water in the engine room. That should say something to you. Those events are on record. They did occur.

Mr. MILLER. So you are saying that statement may be true when applied to those ferries designed today? But it does not apply to a lot of older ferries?

Captain JACOBS. It may be more true for the ferries that are built today, but it is definitely less true for some of the older ones.

Captain DAVIS. You know, we are talking here about water tight doors, and sprinkler systems. Let me just lay something on you. Our sprinkler systems are not activated by temperature. They are not activated by heat. They are activated in the engine room by the engine room personnel who are hidden from the scene of the fire, or from other places on the vessel. They are activated by human beings, and human beings make mistakes.

The water tight doors are not automatic. They are not always closed. They are activated by human beings from the wheelhouse, positioned on deck, or from the engine room. If my figures are right, in all the major maritime disasters, 70 percent of the causes for those disasters are human error.

So on the sprinkler system and on the water tight, we are talking about things that are wonderful devices, thank God for them. They are activated by human beings. And I make loads of mistakes. So somebody else must make some too.

Mr. LOWRY. Thank you.

Captain Wheeler, you talked about—are you on the schedule now that you read at the beginning?

Captain WHEELER. No, this was an offering. I am on another schedule, the so-called improvement, at Bremerton. I am on this schedule now, one of the so-called improved Bremerton schedules.

Mr. LOWRY. Those were only on summer schedules?

Captain WHEELER. On summer schedules, this is an added one. Nevertheless, there are many schedules year round that are not as bad as this one but that are equal to this and have problems that still happen to everybody who works them.

Mr. LOWRY. Is it your opinion that that schedule would increase the likelihood of an error? How do you answer that question.

Captain WHEELER. Yes. I know that when it has happened every summer for the last couple of years that nobody takes it twice. It is a killer.

Mr. LOWRY. Do they feel that it makes them less capable from a safety standpoint?

Captain WHEELER. Yes.

Mr. LOWRY. And people that you know are people who have worked that schedule say that?

Captain WHEELER. Yes.

Mr. LOWRY. Captain Davis.

Captain DAVIS. Let me make one statement on fathometers. I will say it and we will get out of here.

Mr. LOWRY. Okay.

Captain DAVIS. Fathometers. All vessels over 1600 tons navigating inland waters of the United States are required by law to be equipped with fathometers. Ferries of comparable size on all the other ferry systems in the United States are equipped with fathometers. These systems operate only once, on only one route. Washington State ferries operate eight routes, more than one mile to over 30 miles in length in an area extending north and south for 90 miles. It is regular practice in our system to move vessels and crews from one to another.

British Columbia ferries operate in light conditions and having many double ended vessels with the same propeller and hull configurations, all equipped with fathometers.

Our two major navigational tools are the compass and the radar. As important as these are, they cannot tell us the actual depth of the water. We assume what the depth is, even when we assume that we are perhaps an eighth of a mile or less from a mudbank or a sandbank that may have shifted since the last soundings remain.

And as an example, in Kingston we are making an approach in the fog in the old slip right along a mudbank. Each one of us goes a quarter mile from the beach. This is traditional rule of thumb. They put a breakwater on the edge of Kingston Harbor to create a marina. So we do not know what the hydraulic effect of the tidal flow in and out of that basin, the tidal basin, is going to be on that mudbank over a 20 year time. We do not know. We are assuming this, and to assume is just ridiculous. We also are to assume that the bottom never shifts and that our memories of the depths foot by foot over 90 miles is perfect, and that is not true. I could not remember depth by depth, or foot by foot, soundings over 90 miles. I just could not do it.

The fathometers have prevented hundreds of ships from grounding. In my opinion, at least two recent groundings in our system could either have been prevented, or the impact of the collision, or of the grounding, could have been lessened if we had a forward seeking fathometer with an alarm. In other words, even if we did go aground, reaction time would be faster, the impact of the grounding would be less. They are not expensive.

The United States Coast Guard has exempted all Washington State ferries from this rule. I could go on and on about this, but I know you are limited for time. They have denied fathometers with-

out consulting our deck officers who legally bear total responsibilities for the safe navigation of our vessels. They seem to never ask us, 52 captains, said "come on, we need liferafts," and you know that not one of those captains was called by the Coast Guard. You know that not one of them was called by the company. They have denied fathometers without consulting the deck officers who are bearing the total responsibility for the safe navigation of the vessels.

I therefore recommend, one, that the exemption be removed, and, two, I ask that before any exemptions be granted in the future, provide the navigation equipment, that the captains of the vessels be consulted.

Thank you.

Mr. LOWRY. Thank you. I thank the panel for their very helpful testimony, and I would like to thank everybody for coming.

The committee's record will be open for ten days for any additional comments anybody would care to make. An easy way to do that would be to give the comments either to Congressman Miller or my office, and we will get them into the record. And also the committee hearing will be held open for questions which we will submit to the witnesses.

So I want to thank everybody very much, and we thank the reporter and the committee staff for shooting up their holiday, and weekend, for coming out and helping us. Thank you.

[Whereupon, at 4:40 p.m., the hearing was adjourned.]

[The following material was submitted for the record:]

I

100TH CONGRESS
2D SESSION

H. R. 4518

To amend title 46, United States Code, to enhance the safety of passengers and employees on ferries operating on Puget Sound.

IN THE HOUSE OF REPRESENTATIVES

MAY 3, 1988

Mr. LOWRY of Washington introduced the following bill; which was referred to the Committee on Merchant Marine and Fisheries

---

A BILL

To amend title 46, United States Code, to enhance the safety of passengers and employees on ferries operating on Puget Sound.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. DEFINITION.

Section 2101 of title 46, United States Code, is amended by adding at the end the following:

"(48) 'ferry vessel' means a passenger vessel of more than 1,300 gross tons which—

"(A) is used to carry passengers and automobiles; and

"(B) is not equipped with overnight passenger accommodations.".

SEC. 2. SAFETY EQUIPMENT ON FERRY VESSELS.

(a) IN GENERAL.—Section 3306 of title 46, United States Code, is amended by adding at the end the following:

"(h)(1) Regulations prescribed under this section shall require that each ferry vessel which operates on any of the waters described in paragraph (2) shall be equipped with liferafts with sufficient capacity to accommodate all passengers and employees on such vessel.

"(2) Waters referred to in paragraph (1) are the following:

"(A) Puget Sound, Washington, including the connecting waters and tributaries thereto.

"(B) The Strait of Juan de Fuca.

"(C) Waters on which a ferry operates in traveling between a point in the San Juan Islands, Washington, and a point in Vancouver, British Columbia, Canada.".

(b) ISSUANCE OF REGULATIONS.—The head of the department in which the Coast Guard is operating shall issue regulations implementing this section not later than January 1, 1989. Such regulations shall take effect January 1, 1990.

STATEMENT OF ADM. HAROLD W. PARKER, ASSISTANT SECRETARY OF TRANSPORTATION, MARINE DIVISION, STATE OF WASHINGTON

GOOD AFTERNOON MR. CHAIRMAN, FOR THE RECORD I AM HAROLD PARKER, ASSISTANT SECRETARY OF TRANSPORTATION, MARINE DIVISION, STATE OF WASHINGTON.

AS I UNDERSTAND IT SIR, THIS HEARING IS TO LOOK INTO SAFETY PRACTICES THROUGHOUT THE STATE FERRY FLEET WITH PARTICULAR FOCUS ON THREE ISSUES THAT HAVE BEEN QUESTIONED:

- ONE OF YOUR COMMITTEE'S CONCERNS MR. CHAIRMAN, CENTERS AROUND THE FACT THAT NONE OF THE AUTO FERRIES OF THE WASHINGTON STATE FERRY SYSTEM, IS REQUIRED TO BE EQUIPPED WITH SUFFICIENT LIFE RAFTS AND/OR LIFEBOATS TO ACCOMMODATE A MAXIMUM CAPACITY PASSENGER LOAD OF ONE OF THE BOATS. THESE MAXIMUM ALLOWABLE LOADS VARY DEPENDING ON THE CLASS OF THE FERRYBOAT BUT THEY RANGE FROM 2500 PASSENGERS EACH ON THE SUPER CLASS (LIKE THE YAKIMA OR ELWHA) DOWN TO 200 ON THE HIYU.

- THE SECOND ISSUE IS THAT WASHINGTON STATE FERRIES DO NOT CARRY FATHOMETERS OR DEPTHSOUNDERS.

- AND THE THIRD ISSUE OR CONCERN, RAISED AFTER A SURVEY CONDUCTED BY DR. PATRICIA SPARKS, AND COMMISSIONED BY THE FERRY SYSTEM, REPORTED THE WATCH ROTATION SCHEDULE WAS AFFECTING THE HEALTH, SLEEP, APPETITE AND CERTAIN OTHER BODILY FUNCTIONS OF SOME MASTERS.

THIS REPORTEDLY CONTRIBUTED TO FATIGUE WHICH IN TURN MAY HAVE CONTRIBUTED TO SOME VESSEL ACCIDENTS AND REPORTED NEAR MISSES. THE SPARKS REPORT WAS NON-SPECIFIC ON THIS LATTER AND NO ACTUAL INCIDENTS WERE RELATED.

SAFETY IS A MAJOR CONCERN OF THE FERRY SYSTEM MR. CHAIRMAN, AND EACH OF THE ISSUES WILL BE ADDRESSED IN THE TESTIMONY. TO DO THESE SUBJECTS JUSTICE, ON BEHALF OF THE WASHINGTON STATE FERRY SYSTEM, THERE ARE PRESENT WITH ME THIS AFTERNOON, THREE WITNESSES WITH FIRST HAND KNOWLEDGE: PROFESSIONAL EXPERTISE: OR MARITIME SAFETY EXPERIENCE. THEY ARE:

- MR. PHILLIP SPAULDING, REGISTERED NAVAL ARCHITECT AND DESIGNER OF SEVERAL SHIPS INCLUDING OUR JUMBO CLASS FERRIES, AND

- CAPTAIN JOHN DeCARTERET, RETIRED COAST GUARD OFFICER AND LONG TIME MARITIME SAFETY EXPERT, WITH OVER 26 YEARS OF EXPERIENCE IN THE FIELD.

AS THE COMMITTEE WISHES THESE GENTLEMEN CAN TESTIFY OR RESPOND TO YOUR QUESTIONS ON SAFETY, STABILITY, FLOTATION AND OTHER MATTERS RELATIVE TO CARRIAGE OF LIFE RAFTS.

- MR. ARMAND TIBERIO, DIRECTOR OF VESSEL OPERATIONS, WASHINGTON STATE FERRY SYSTEM, IS PREPARED TO ADDRESS THE ACTION TAKEN BY FERRY SYSTEM MANAGEMENT UPON RECEIPT OF THE SPARK'S REPORT.

MR. TIBERIO'S WORK GROUP WAS ABLE TO REARRANGE THE WATCH, OR SHIFT ROTATION PATTERN, TO REDUCE THE DESYNCHRONIZATION RHYTHM, AS RECOMMENDED BY DR. SPARKS. EACH OF THESE GENTLEMEN HAVE ALSO PREPARED STATEMENTS AND THEY ARE ATTACHMENTS TO THIS TESTIMONY, AS IS A FOLLOW-UP LETTER FROM DR. SPARKS COMMENTING FAVORABLE ON OUR NEW SCHEDULE.

I THINK YOU WILL FIND MR. CHAIRMAN, THAT FERRY SYSTEM MANAGEMENT TOOK THE SPARKS REPORT SERIOUSLY, AND IN A TIMELY MANNER, PREPARED AND INSTITUTED A MAJOR WATCH SCHEDULE ROTATION CHANGE THAT IS FAR SUPERIOR TO THE FORMER SCHEME.

WITH YOUR INDULGENCE MR. CHAIRMAN, I NOW WOULD LIKE TO SPEAK TO WHAT SEEMS TO BE A PERCEIVED NEED FOR, NEW REGULATIONS REQUIRING 100% LIFE RAFT CAPACITY ON WASHINGTON STATE FERRYBOATS.

I SAY "PERCEIVED" BECAUSE ALTHOUGH THIS HEARING IS BEING HELD PARTIALLY TO TAKE TESTIMONY ON THE NEED FOR MORE RAFTS TO CORRECT A REPORTED SERIOUS SAFETY PROBLEM, I DO NOT AGREE THAT ANY SERIOUS PROBLEM HAS BEEN ESTABLISHED WITH OUR SAFETY AND INSTEAD OF A SERIOUS SAFETY PROBLEM, WASHINGTON STATE FERRIES HAS AN OUTSTANDING SAFETY RECORD. THAT RECORD IS DUE PARTLY TO CREW SKILL, PARTLY TO GOOD ENGINEERING DESIGN AND, PARTLY TO EXCELLENT COAST GUARD REGULATIONS.

IT IS PERPLEXING TO ME WHY FEDERAL LAW SHOULD BE AIMED SOLELY AT THE HEART OF THE WASHINGTON STATE FERRY SYSTEM. OTHER SYSTEMS IN OTHER STATES LOOK TO US AS THE EXAMPLE OF THE EXCELLENCE THEY WOULD LIKE TO ATTAIN. SURELY OUR WATERS ARE NO COLDER THAN BOSTON'S, SAN FRANCISCO'S,

NEW YORK'S, DELAWARE'S OR MICHIGAN'S TO NAME A FEW. BE THAT AS IT MAY, WE ARE SINGLED OUT SO WE SHALL TRY TO RESPOND.

RECENTLY I HAVE READ IN THE NEWSPAPER THAT SOME PEOPLE HAVE BEEN QUOTED AS SAYING 100% RAFTING ON THE FERRYBOATS IS "COMMON SENSE." THIS IMPLIES ANYONE WHO TAKES ANY OTHER POSITION DOES NOT HAVE COMMON SENSE AND THE REGULATIONS THAT HAVE BEEN IN EFFECT FOR YEARS WERE WRITTEN AND PERIODICALLY REVIEWED BY MARINE SAFETY PROFESSIONALS WHO MUST HAVE LACKED COMMON SENSE. I THINK COMMON SENSE INCLUDES NOT SPENDING MONEY TO FUND EVERY IDEA THAT COMES TO MIND. COMMON SENSE DICTATES THAT OFFICIALS ENTRUSTED WITH THE PUBLIC TREASURE GET THE BEST VALUE THEY CAN FROM LIMITED AVAILABLE TAX DOLLARS

I THINK COMMON SENSE INCLUDES HAVING A HEALTHY CYNICSM TOWARD SELF STYLED EXPERTS THAT ESPOUSE AS FACTUAL INFORMATION THEIR OWN PERSONAL OPINION, UNWARRANTED SUPPOSITION, UNSUBSTANTIATED GUESSING AND UNJUSTIFIABLE DISTORTION (THESE WORDS ARE FROM RADM JOE JAPP, USN-RET).

WE HAVE SOME SERIOUS QUESTIONS ABOUT A BILL THAT COULD BECOME LAW REQUIRING THE COAST GUARD TO HURRIDLY SLAP REGULATIONS ON A FERRY SYSTEM WITH A PERFECT RECORD. THESE REGULATIONS HAVE A COST POTENTIAL THAT COULD SERIOUSLY AND ADVERSELY AFFECT THE FARE SYSTEM. COMMON SENSE IS NOT PLACIDLY ACCEPTING CHANGE WITHOUT POSITIVE ASSURANCE OTHERWISE.

H.R. 4518 INTRODUCED ON MAY 3RD WOULD REQUIRE THE COAST GUARD TO ISSUE REGULATIONS FOR EACH FERRY VESSEL OVER 1300 GROSS TONS OPERATING ON PUGET SOUND AND THE CONNECTING AND ADJACENT WATERS, TO BE EQUIPPED WITH LIFE RAFTS WITH SUFFICIENT CAPACITY TO ACCOMMODATE ALL PASSENGERS AND EMPLOYEES ON SUCH VESSELS.

TAKEN ON THE SURFACE IT SEEMS LIKE A GOOD IDEA.

IF A FERRY LOADED TO MAXIMUM CAPACITY WITH PASSENGERS AND CREW IS FOUNDERING, SINKING OR BURNING, ABANDON SHIP IS ORDERED, AND NO HELP IS NEARBY, THEN CERTAINLY THERE MUST BE LIFEBOATS AND LIFE RAFTS FOR EVERYONE, OR SOME PEOPLE WILL DROWN.

BUT LET'S LOOK BENEATH THE SURFACE OF THIS SPECIFIC ISSUE OF FERRYBOAT SAFETY ON PUGET SOUND. AND WHILE WE ARE LOOKING, REMEMBER WHAT OGDEN NASH SAID:

> "FOR EVERY COMPLEX ISSUE THERE IS A SOLUTION THAT IS SIMPLE, PLAUSIBLE AND WRONG."

WE CAN'T AFFORD TO BE WRONG ON THE RAFT ISSUE.

PROVIDING 100% RAFTING CAPACITY IS NOT A NEW IDEA. NO, ON THE CONTRARY, IT HAD BEEN THOUGHT OF IN MARINE SAFETY CIRCLES AND DISCUSSED AT GREAT LENGTH. COAST GUARD REGULATIONS PRESENTLY REQUIRE U.S. VESSELS CARRYING PASSENGERS IN CERTAIN TRADES TO HAVE 100% CAPABILITY UTILIZING EITHER LIFEBOATS OR RAFTS. AMONG VESSELS THAT FIT THIS CATEGORY, ARE OCEAN LINERS AND CRUISE SHIPS.

BUT OCEAN LINERS AND CRUISE SHIPS GO TO SEA AND CONSEQUENTLY CAN BE HUNDREDS OF MILES FROM LAND OR EVEN ANOTHER SHIP.

WASHINGTON STATE FERRIES NEVER GET MORE THAN 2½ MILES FROM THE BEACH AND THERE ARE ALWAYS SHIPS UNDERWAY IN PUGET SOUND, EVEN IF IT'S ONLY ANOTHER FERRY.

MARINE SAFETY AMOUNTS TO MORE THAN HAVING A BUNCH OF LIFE RAFTS MOORED ALONGSIDE A SLOWLY SINKING SHIP READY FOR SURVIVORS TO JUMP IN AND WAIT TO BE RESCUED. IT DOESN'T WORK LIKE THAT.

AND IF THAT'S THE BEST WE COULD DO TO INSURE THAT OUR 18½ MILLION PASSENGERS A YEAR CONTINUE TO HAVE SAFE CROSSINGS, THEN I WOULD BE THE FIRST IN LINE TO TESTIFY BEFORE THE WASHINGTON STATE LEGISLATURE ASKING FOR A BILLION DOLLAR CROSS-SOUND BRIDGE, AND TIE THE FERRYBOATS UP.

BUT IT'S NOT THE BEST WE CAN DO. MARINE SAFETY IS NOT A THING OR A GIMMICK, IT IS A SYSTEM MR. CHAIRMAN, A VERY COMPLEX SYSTEM THAT HAS BEEN DEVELOPED OVER THE YEARS. THE LEAD ROLE IN DEVELOPING THE SYSTEM HAS BEEN GIVEN TO THE UNITED STATES COAST GUARD.

THEY USE MANY TECHNIQUES IN DEVELOPING THE REGULATIONS THAT, TAKEN COLLECTIVELY, COMPRISE THE SYSTEM. RESEARCH AND DEVELOPMENT; FIELD TESTING OF LIFESAVING DEVICES; PUBLIC HEARINGS, SHIP PLANS REVIEW; TO NAME A FEW. PROBABLY THE MOST INTERESTING TECHNIQUE IS THE THOROUGH ANALYSIS OF MARINE CATASTROPHES, SUCH AS COLLISION, SINKING, FIRE, GROUNDING, AND EXPLOSION.

OUT OF THOSE ANALYSES COME THE REGULATIONS THAT HAVE MADE AMERICA'S PASSENGER CARRYING FLEET THE SAFEST IN THE WORLD TODAY.

FROM THE TITANIC SINKING CAME WATERTIGHT INTEGRITY AND PROGRESSIVE FLOODING REGULATIONS. FROM THE MORRO CASTLE FIRE - STRUCTURAL FIRE PROTECTION AND FLAMMABLES LIMITATION. FROM THE ANDREA DORIA COLLISION - MAXIMUM LIST ANGLE TO LAUNCH LIFEBOATS.

I COULD GO ON, I HAD 36 YEARS SERVICE IN THE COAST GUARD, 8 YEARS IN BOATING SAFETY AND 3 YEARS ON THE NATIONAL MARINE SAFETY COUNCIL. BUT MY EXPERIENCE IN THIS FIELD PALES NEXT TO CAPTAIN JOHN DeCARTERET WHO MADE A CAREER OF MARINE SAFETY AND IS WAITING TO TESTIFY BEFORE YOU OR ANSWER ANY SPECIFIC QUESTIONS YOU MAY HAVE.

ALL, ANYONE FAMILIAR WITH GOING TO SEA TODAY NEEDS DO, IS REFLECT ON SUCH MEASURES AS TRAFFIC LANES; RADAR PILOTING REQUIREMENTS; VESSEL TRAFFIC SYSTEMS; BRIDGE TO BRIDGE COMMUNICATIONS, ETC, ETC..

THE CODE OF FEDERAL REGULATIONS IS SO FULL OF RULES FOR MARINE SAFETY THAT HAVE BEEN MADE SINCE I FIRST SAILED AS AN ENSIGN IN 1950, THERE IS NO WAY THEY CAN ALL BE COVERED AT YOUR HEARING TODAY, MR. CHAIRMAN. I READ IN THE PAPER THE OTHER DAY WHERE ONE OF OUR OWN FERRY SYSTEM CAPTAINS WAS COMPLAINING BECAUSE THE COAST GUARD RULES SETTING FORTH THE NUMBER OF LIFE RAFTS HAD NOT BEEN CHANGED SINCE 1946. TO THIS I SAY "SO WHAT?" THAT DOESN'T MEAN THE RULE HASN'T BEEN LOOKED AT. IN 1946,

WHEN RETURNING FROM SEA A RED BUOY WAS KEPT TO STARBOARD..... IT STILL IS. IN 1946, A RED LIGHT AT THE STREET CORNER WAS A SIGNAL TO STOP YOUR CAR..... IT STILL IS.

SHOULD THESE REGULATIONS BE CHANGED? PROBABLY NOT.

THE PAPER REPORTED THE SAME FERRY CAPTAIN ALSO SAID SHIPS HAVE CHANGED. THE SHIPS ARE BIGGER AND FASTER. THAT'S PARTLY TRUE, SOME ARE BIGGER, SOME ARE FASTER. BUT ALL NOW HAVE RADAR, GYRO COMPASSES, BRIDGE TO BRIDGE COMMUNICATIONS, VTS COVERAGE - YES, THINGS HAVE CHANGED SINCE 1946 - FOR THE BETTER.

NOW, IF YOU SHOULD ASK ME, "DO I THINK A FERRYBOAT CAN SINK?" MY ANSWER IS:

> "YES, I DO." ANYTHING THAT CAN FLOAT CAN BE MADE TO SINK. IN THE CASE OF A FERRY, JUST OVERCOME THE BUOYANCY AND OPEN UP THE REQUISITE NUMBER OF WATERTIGHT COMPARTMENTS TO THE SEA.

IF YOU SHOULD ASK ME, "DO I THINK A FERRYBOAT WILL SINK?" MY ANSWER IS:

> "NO, I DON'T." THERE ARE ENOUGH SAFETY FEATURES IN PLACE TO PREVENT IT.

LET ME EXPLAIN BECAUSE THIS IS AN IMPORTANT POINT.

OUR MASTERS AND MATES ARE LICENSED OFFICERS WHO MUST PROVE THEIR SKILL AND EXPERIENCE BEFORE THEY CAN EVEN GET THE JOB. WE DON'T HIRE PEOPLE OFF THE STREET. THE GREAT SHIPS OF THE SEA (NOT THE LITTLE TUGS AND FISHING BOATS THAT RUN AROUND THE HARBOR OUT HERE) BUT THOSE THAT COULD SEVERELY DAMAGE A FERRY IN A COLLISION ARE REQUIRED TO CARRY LICENSED PILOTS WHEN IN THE SOUND.

WHILE ON THE SUBJECT OF BIG OCEAN GOING SHIPS IN PUGET SOUND, THERE WERE A COUPLE OF ARTICLES IN THE PAPER LAST FEBRUARY APPEARING IN THE SAME ARTICLE ANNOUNCING THESE HEARINGS, THAT REPORTED THE FERRY SYSTEM SHARED THE STATE'S INLAND WATERS WITH MORE THAN 200,000 VESSELS EACH YEAR NOT INCLUDING SAILBOATS, PLEASURE BOATS OR FISHING BOATS.

THIS SEEMED TO BE A LITTLE EXAGERATED FOR THIS OLD SAILOR'S EYES SO I HAD MY OPERATION STAFF QUERRY THE COAST GUARD VESSEL TRAFFIC SYSTEM OFFICE TO VERIFY THE INFORMATION PRINTED IN THE TWO NEWSPAPERS.

THIS IS WHAT WE LEARNED - FOR CALENDAR 1987 THERE WERE IN FACT 212,853 VESSEL MOVEMENTS IN THE ENTIRE PUGET SOUND, STRAITS OF JUAN DE FUCA, ADMIRALTY INLET AND ADJACENT WATERS, OF THESE:

- 1,984 WERE TANKERS
- 10,614 WERE FREIGHTERS
- 29,611 WERE TUGBOATS
- 13,621 WERE GOVERNMENT OR MISCELLANEOUS CRAFT
- FOR A TOTAL OF 55,840 VESSEL MOVEMENTS

THE REMAINING 157,013 VESSEL MOVEMENTS ON PUGET SOUND WERE MADE BY WASHINGTON STATE FERRYBOATS. THIS WOULD LEND ONE TO THE CONCLUSION THAT THE BIGGEST THREAT WE FACE IS RUNNING INTO OURSELVES.

WE HAVE MET THE ENEMY AND THEY ARE US. SO BEWARE OF UNSUBSTANTIATED FACTS EVEN WHEN THEY APPEAR IN THE NEWSPAPER.

TO PUT THESE GROSS NUMBERS INTO PERSPECTIVE AS TO THE GREAT HAZARD THEY PRESENT THE FERRIES LET US SUBTRACT FROM THIS TOTAL OF 212,853 VESSELS THE 157,013 FERRY MOVEMENTS, THE 29,611 TUGBOATS (THEY CAN'T SINK A FERRY) AND THE GOVERNMENT AND MISCELLANEOUS CRAFT. THAT LEAVES 12,598 FREIGHTERS AND TANKERS A YEAR. THE VTS MONTHLY AVERAGE IS POSTED AT 1,040 FREIGHTERS AND TANKERS PER MONTH. THIS IS 35 SHIPS PER 24 HOUR DAY MOVING IN PUGET SOUND WATERS.

WHEN ONE CONSIDERS THAT IT IS OVER 60 MILES FROM PORT TOWNSEND TO TACOMA, AND EVEN IF YOU FIGURE EVERY SHIP WAS TACOMA BOUND AT ONLY 10 KNOTS, AT THE MOST THERE WOULD ONLY BE 9 FREIGHTERS OR TANKERS ON AVERAGE IN THE SOUND AT ANY ONE TIME. SOMEHOW THE FERRY CAPTAINS WITH THE HELP OF THE COAST GUARD VTS SHOULD BE ABLE TO SUCCESSFULLY CONTINUE TO AVOID HITTING ONE. IF YOU DON'T BELIEVE ME AS TO OUR UNCROWDED WATERS, JUST GO TO THE BEACH AND LOOK FOR A SHIP SOMETIME.

BUT WHEN TWO VESSELS ARE IN A CROSSING SITUATION IN THE SOUND, TWO LICENSED PROFESSIONALS ARE AT THE CONTROLS.

BOTH PILOTS KNOW THE RULES OF THE ROAD, AND WHEN OBEYED BY PROFESSIONALS, AVOIDING COLLISION IS EASY. I HAVE SERVED ON 8 SHIPS AND COMMANDED 3. NO COLLISIONS.

NOW BY SAYING THAT, I AM NOT TRYING TO PASS MYSELF OFF AS A GREAT MARITIME SAFETY EXPERT JUST BECAUSE I COMMANDED SHIPS FOR A FEW YEARS. BEING IN COMMAND SERVES TO GIVE ONE EXCEPTIONAL EXPERTISE IN SAFE MANEUVERING AND WORKINGS OF HIS OR HER PARTICULAR SHIP, BUT NOT NECESSARILY A TOTAL GRASP OF THE MARITIME SAFETY SYSTEM.

BOTH SHIPS HAVE RADARS AND THE OFFICERS ARE TRAINED TO USE THEM, SO EVEN IF THEY CAN'T SEE THE OTHER SHIP THEY CAN MANEUVER AROUND HER.

BOTH HAVE RADIOS AND TALK TO EACH OTHER ON VHF CHANNEL 13 THUS EXPLAINING WHAT THEY ARE DOING, WHAT COURSE THEY ARE ON, HOW FAST THEY ARE GOING, WHICH WAY THEY ARE TURNING, ETC.

BOTH ARE IN CONTACT WITH THE 13th COAST GUARD DISTRICT'S VESSEL TRAFFIC SYSTEM CONTROLLER, WHO HAS THEM ON HIS RADAR AND IS ALSO IN VOICE COMMUNICATION.

NOW IF ALL THIS BREAKS DOWN:

- IF THE VTS CONTROLLER IS AWAY FROM HIS STATION <u>AND</u>

- IF ONE OF THE SHIP'S RADIOS FAILS AND
- IF A MASTER DOES NOT FOLLOW THE RULES OF THE ROAD
- THEN A COLLISION IS POSSIBLE, IF BOTH SHIPS ARRIVE AT THE SAME SPOT IN THE SOUND AT THE SAME TIME.

POSSIBLE - YES. NOT LIKELY, BUT POSSIBLE. WHAT I JUST DESCRIBED COULD BE CALLED THE (MANEUVERING) PHASE OF A MARINE DISASTER. PEOPLE MANEUVER SHIPS, PEOPLE MAKE MISTAKES. IT WOULD TAKE A WHOLE SEQUENCE OF MISTAKES FOR THE SYSTEM TO BREAK DOWN, BUT ANYTHING IS POSSIBLE.

THE NEXT PHASE COULD BE CALLED THE (DAMAGE) PHASE. THE COLLISION, THE FIRE, THE GROUNDING, WHATEVER. THERE ARE ALSO A WHOLE SERIES OF COAST GUARD REGULATIONS IN PLACE TO MITIGATE DAMAGE, SHOULD IT OCCUR.

THESE ARE BUILT-IN FEATURES, PRESCRIBED BY THE COAST GUARD, DESIGNED BY THE ARCHITECT AND CONSTRUCTED BY THE SHIPYARD WITH INSPECTIONS ALL ALONG THE WAY.

SUCH THINGS AS SPRINKLER SYSTEMS, FIREWALL INSULATION, WATERTIGHT BULKHEADS, 1 OR 2 COMPARTMENT SUBDIVISIONS, CO^2 SMOTHERING SYSTEMS, HEAT AND SMOKE ALARMS, AND SO ON. THESE ARE FEATURE SELDOM, IF EVER, SEEN BY THE PASSENGERS.....WE WORRY ABOUT THEM SO THE PASSENGERS WON'T HAVE TO.

SO FAR AS SHIPBOARD FIRES GO, THERE IS LITTLE ON THE FERRIES THAT WILL BURN. THIS IS BY DESIGN, NOT CHANCE. YEARS AGO SHIPS WERE MADE OF WOOD, WE AREN'T SAILING ANY OF THOSE THESE DAYS. BUT IF A FIRE SHOULD OCCUR

WE'RE READY FOR IT. WE REGULARLY SEND OUR FERRYBOAT OFFICERS AND CREWMEN TO THE STATE FIREFIGHTING SCHOOL IN NORTH BEND TO TRAIN IN THE LATEST TECHNIQUES.

IN A GROUNDING YOU ARE ALREADY ON THE BOTTOM SO SINKING IS NOT A CONCERN. THE PROBLEM HERE IS THREEFOLD;

- THERE IS A GREAT DELAY IMPOSED ON THE PASSENGERS.
- WHEN THE TIDE GOES OUT THE FERRY MIGHT HEEL OVER 20 OR 30 DEGREES MAKING IT TOUGH TO WALK ABOUT THE DECK. AND...
- THE CAPTAIN'S CAREER USUSALLY SUFFERS BECAUSE HIS ERROR COST THE COMPANY EMBARRASSMENT AND MONEY.

BUT WHAT HAS CAPTURED THE FANCY OF THE MEDIA THESE PAST SEVERAL WEEKS, HAS BEEN NEITHER FIRE NOR GROUNDING, BUT RATHER <u>COLLISION.</u>

THE SPECTRE HAS BEEN RAISED OF SOME LARGE OCEAN-GOING SHIP, UNDER CONTROL OF A LICENSED PILOT SOMEHOW CIRCUMVENTING ALL THE CONTROLS I JUST DISCUSSED AND PLOWING INTO THE SIDE OF ONE OF OUR SUPER FERRIES, WHOSE CAPTAIN ALSO COULDN'T FIGURE OUT HOW TO AVOID A COLLISION.

FOR THE SAKE OF AN EXAMPLE LET'S SAY IT ACTUALLY HAPPENS SOME DAY. THE SCENARIO WOULD BE SOMETHING LIKE THIS:

THE REGULATIONS GOVERNING THE MANEUVERING STAGE HAVE FAILED TO PREVENT THE COLLISION, THE REGULATIONS GOVERNING THE DAMAGE PHASE HAVE FAILED TO MITIGATE THE FLOODING AND WE NOW HAVE A SINKING FERRYBOAT IN THE MIDDLE OF PUGET SOUND. WE HAVE JUST ENTERED THE <u>SURVIVAL</u> PHASE OF A MARINE DISASTER.

LET ME QUALIFY MY OBSERVATIONS OF WHAT I CAN SEE HAPPENING BY TELLING THE COMMITTEE, WHEN I WAS A LIEUTENANT I WAS A SEARCH AND RESCUE CONTROLLER IN NEW YORK FOR OVER THREE AND A HALF YEARS, COORDINATED THE RESCUE OF HUNDREDS OF BOATS AND A FEW SHIPS UP AND DOWN THE EASTERN SEABOARD AND WAS LUCKY ENOUGH TO BE ON WATCH THE NIGHT THE ANDREA DORIA AND STOCKHOLM COLLIDED OFF NANTUCKET. IT WAS I WHO COORDINATED THE RESCUE OF THE 1800 SURVIVORS OF THE ANDREA DORIA. SO I DO KNOW SOMETHING OF MARINE DISASTERS.

<u>BACK TO THE FERRYBOAT.</u> IN YOUR MATERIAL BEFORE YOU IS A PHOTOGRAPH OF A B.C. FERRY THAT WAS HIT BE A RUSSIAN FREIGHTER IN ACTIVE PASS IN THE EARLY 70'S. THIS SHIP, LIKE OUR BIG FERRIES HAD TWO COMPARTMENT SUBDIVISION. EVEN IF THIS RUSSIAN'S BOW HAD PENETRATED TWO OF THEIR WATERTIGHT COMPARTMENTS THE FERRY WOULD NOT SINK. IF BY SOME MIRACLE THEY VIOLATED THREE THEN THE FERRY MASTER COULD STEER FOR SHALLOW WATER, A MILE OR TWO AWAY, AND GROUND THE BOAT.

COULD ONE OF OUR BOATS SUFFER SO MUCH DAMAGE IN A COLLISION THAT IT WOULD SINK?

I DOUBT IT BUT... WHY DON'T YOU ASK A NAVAL ARCHITECT LIKE MR. PHIL SPAULDING, WHO IS HERE WITH ME TODAY. IN ADDITION TO OUR JUMBO CLASS FERRIES HE ALSO DESIGNED THE B.C. FERRY "QUEEN OF VICTORIA" IN YOUR PICTURE. I FEEL THERE ARE TIMES WHEN A SPECIALIST SHOULD BE CONSULTED. WHEN YOU HAVE A CHEST PAIN GO TO A CARDIOLOGIST, WHEN YOU WANT TO SUE SOMEONE, GET A LAWYER AND WHEN YOU NEED SHIP STABILITY INFORMATION ASK A NAVAL ARCHITECT.

SINCE WE ARE EXAMINING THIS FROM THE STANDPOINT OF NEED FOR 100% RAFTING MR. CHAIRMAN, LET US ASSUME THAT THE HYPOTHETICAL MID-SOUND COLLISION IS FATAL TO THE FERRY, BECAUSE SUFFICIENT WATERTIGHT COMPARTMENTS ARE BREACHED TO SLOWLY OVERCOME FLOTATION AND ALL ENGINES ARE DISABLED SO THE CAPTAIN CAN'T BEACH HER. MOST OF THE PASSENGERS AND CREW HAVE SURVIVED THE IMPACT AND HERE WE ARE ON A DISABLED, DOOMED FERRY WITH INSUFFICIENT LIFE RAFTS TO ACCOMMODATE 2500 PEOPLE THE MAXIMUM ALLOWABLE LOAD.

WHAT TO DO? FIRST THE CAPTAIN SENDS THE S.O.S. OR MAYDAY; THAT ALERTS THE COAST GUARD RESCUE CENTER AS WELL AS ALL THE SHIPS AND BOATS IN THE AREA GUARDING THAT FREQUENCY. THE COAST GUARD VTS CONTROLLER PROBABLY ALREADY HAD AN INKLING THAT SOMETHING WAS UP, WHEN THE TWO RADAR BLIPS HE WAS PLOTTING, MERGED AND NEVER CAME APART.

HELP IS REQUIRED - WHERE'S THE NEAREST SHIP? HOW ABOUT THE BIG ONE WITH HER BOW STUCK IN THE FERRY'S SIDE? THE DECKS PROBABLY WON'T MATCH SO ONE CAN'T STEP ACROSS, BUT SHE WILL HAVE BOATS AND RAFTS THAT CAN SHUTTLE BACK AND FORTH IF "ABANDON SHIP" IS ORDERED BY THE CAPTAIN.

OUR ROUTE SCHEDULES GENERALLY HAVE THE TWO BOATS LEAVING EACH TERMINAL AT THE SAME TIME AND MEETING IN THE MIDDLE. SO THAT SISTER FERRY IS GOING TO BE PRETTY CLOSE IF THE COLLISION TOOK PLACE IN THE MIDDLE OF THE SOUND. ALSO OUR MASTERS ARE USED TO TIEING UP BOW FIRST SO THEY HAVE THE SKILL TO RUN THEIR BOAT UP END TO END WITH THE STRICKEN FERRY AND MARCH THE SURVIVORS ABOARD. IF FOR SOME REASON THIS IS

IMPRACTICAL, THEY TOO HAVE BOATS AND RAFTS TO SHUTTLE THE PEOPLE. IN AN EMERGENCY, OTHER FERRIES WOULD DEPART THEIR SCHEDULED RUNS AND PROCEED TO ASSIST. IT'S 11 NAUTICAL MILES FROM MUKILTEO TO EDMONDS, 10 FROM KINGSTON TO WINSLOW, 5 FROM WINSLOW TO VASHON. AT 15 KNOTS (AND THE BIG BOATS DO BETTER THAN THAT) YOU HAVE FROM 20 TO 40 MINUTES TRAVEL TIME.

I HAVEN'T EVEN MENTIONED THE SEATTLE COAST GUARD SEARCH AND RESCUE CENTER YET WITH THEIR IMMEDIATE STANDBY BOATS IN THE SOUND AND HELICOPTERS AT PORT ANGELES AND ASTORIA WITH CREWS DRESSED IN FLIGHT SUITS IN THE READY ROOM DAY AND NIGHT. I'LL LET THE COAST GUARD TESTIFY TO THEIR OWN CAPABILITY TO RESPOND TO A S.A.R. CASE. WHEN YOU CALL THE COAST GUARD AT THREE O'CLOCK IN THE MORNING YOU DON'T GET A RECORDING.

AND IF YOU STRUCK AN ARC WITH A 10 MILE RADIUS FROM THE DOWNTOWN SEATTLE FIRE DOCK, YOU WOULD INTERSECT 4 OF OUR BUSIEST FERRY ROUTES. THE SEATTLE FIRE DEPARTMENT IS ALSO ON DUTY 24 HOURS A DAY.

IN THE TESTIMONY UP TO NOW I HAVE BEEN TELLING THE COMMITTEE WHY I THINK 100% RAFTING IS NOT NECESSARY ON FERRIES OPERATING ON PUGET SOUND. IF I HAVE NOT CONVINCED YOU AND CHANGES ARE DIRECTED, OF COURSE WASHINGTON STATE FERRIES SHALL ABIDE BY THE LAWS AND REGULATIONS JUST AS WE ALWAYS HAVE BUT....MR. CHAIRMAN, IF THE CODE OF FEDERAL REGULATIONS IS AMENDED TO REQUIRE 100% RAFTING ON OUR FERRIES, IT WILL HAVE A SIGNIFICANT IMPACT ON THE WASHINGTON STATE FERRY SYSTEM BUDGET.

I UNDERSTAND THE COAST GUARD HAS BEEN WORKING ON CHANGES TO THE CODE OF FEDERAL REGULATIONS FOR ABOUT FOUR YEARS NOW WITH AN EYE TOWARD AMENDING BOTH CARRIAGE AND MANNING REQUIREMENTS. I AM NOT AWARE OF ANY NOTICE OF PROPOSED RULE MAKING THEY HAVE PUT ON THE STREET BUT FOR THAT MATTER I WAS NOT EVEN AWARE THEY WERE WORKING ON CHANGES BACK IN WASHINGTON, D.C. UNTIL RECENTLY.

WE WOULD WELCOME SOME CHANGES IN AREAS OF APPROVED EQUIPMENT AND MANNING REQUIREMENTS. IN FACT WITHOUT SIGNIFICANT CHANGES TO THE MANNING REGULATIONS, CFR 78.14, AS THEY ARE CURRENTLY ENFORCED; THAT IS ONE OFFICER, AB OR CERTIFIED LIFEBOATMAN FOR EACH RAFT; THE COST TO THE WASHINGTON STATE FERRIES FOR ALL THOSE ADDITIONAL SAILORS WOULD BE PROHIBITIVE.

THE MANNING ISSUE, OF THE RAFTS OR INFLATABLE PLATFORMS, SUCH AS OUR VIKINGS IF THEY ARE EVER APPROVED, IS FAR FROM RESOLVED. CONSEQUENTLY THE ANNUAL PERSONAL COSTS QUESTION IS ALSO IN LIMBO.

I READ IN THE BREMERTON SUN NEWSPAPER ON MAY 10th THAT A WOMAN HAD BEEN QUOTED AS SAYING THAT THE COAST GUARD PROBABLY WOULD ALLOW AUTOMATIC INFLATABLE LIFE RAFTS THAT WOULDN'T REQUIRE ANY CREWMEN TO LAUNCH THEM. BUT IN THE SAME ARTICLE I READ THAT A COAST GUARD SPOKESMAN SAID THE MANNING ISSUE WAS STILL UP IN THE AIR AND ANY MANNING REDUCTIONS WOULD HAVE TO BE CONSIDERED FOR APPROPRIATENESS. THE SAME DAY I CALLED COAST GUARD HEADQUARTERS AND GOT A GUESS OF THREE CREWMEN PER DEBARKATION STATION AND LATER THAT MORNING I RECEIVED A CALL FROM THE SEATTLE COAST GUARD OFFICE THAT WE PROBABLY WOULD

NEED ONE CREWMAN PER DEBARKATION STATION. I WAS TOLD A DEBARKATION STATION WOULD LIKELY HAVE 5 OR 6 INFLATABLE DEVICES OR RAFTS ON A SINGLE RACK TO FACILITATE LAUNCHING THEM ALL AT ONCE.

SO WHAT IS IT? NO MORE CREW NEEDED, 1 CREWMAN FOR EACH LIFE RAFT NEEDED OR SOMETHING IN BETWEEN TO FACILITATE LAUNCHING FROM DEBARKATION STATIONS?

AT A PERSONNEL COST OF AT LEAST $40,000 PER CREWMAN ON THE 7 DAY A WEEK FERRIES THAT REQUIRE 3 OR MORE DECK CREWS EACH, YOU CAN READILY SEE WHY THE NUMBER OF ADDITIONAL PEOPLE WE WILL HAVE TO PUT ON THE PAYROLL TO BE READY TO MAN THE RAFTS IS IMPORTANT TO US. ON OCEAN GOING SHIPS AND OTHER VESSELS THAT MAKE EXTENDED UNDERWAY TRIPS, THERE IS ONBOARD A 3 SECTION WATCH. THAT MEANS THAT WHILE ONE WATCH SECTION IS ON DUTY THE OTHER TWO ARE AT LEISURE. IN CASE OF A DRILL OR ACTUAL EMERGENCY HOWEVER, ALL HANDS PARTICIPATE. IN THE CASE OF FERRYBOATS THE OFF DUTY WATCH GOES HOME. THEREFORE, WE HAVE ONE-THIRD THE CREW WE WOULD HAVE IF A FERRY WERE MANNED LIKE A SHIP.

WE ARE NOT A PRIVATE BUSINESS, WE ARE A STATE AGENCY AND WE HAVE A BUDGET TO SUBMIT EACH BIENNIUM TO THE STATE LEGISLATURE AND STATE TRANSPORTATION COMMISSION.

- WE CURRENTLY HAVE DEPLOYED ON OUR BOATS 80 FIFTEEN-MAN RAFTS AND 31 VIKING RAFTS WITH A 45 PERSON RAFT CAPACITY.

- 100% RAFTING COULD REQUIRE 1139 TWENTY-FIVE-MAN RAFTS OR 775 FORTY-FIVE MAN INFLATABLE PLATFORMS.

- AT TODAY'S PRICES THE RAFTS COST ABOUT $4,000 EACH AND PLATFORMS ABOUT $5,000. SO THE CAPITAL OUTLAY WOULD BE BETWEEN $4 AND 5 MILLION.

- THE COAST GUARD REQUIRES RUBBER RAFTS TO BE CERTIFIED ANNUALLY. THE CURRENT CHARGE IS ABOUT $700 PER RAFT SO THAT IS $500,000 TO $800,000 PER YEAR TO ADD TO OUR BUDGET.

- OUR CURRENT OPERATING BUDGET AUTHORIZED BY THE STATE LEGISLATURE IS ONLY $75,000,000/YEAR. IF WE ARE PRESENTED WITH FEDERAL REGULATIONS REQUIRING SEVERAL ADDITIONAL CREWMEN PER FERRYBOAT, THAT COULD BE A SIGNIFICANT INCREASE. THE MONEY WOULD HAVE TO COME FROM STATE TAXES OR THE FAREBOX IF CURRENT SERVICE IS TO BE MAINTAINED.

AS I TESTIFIED EARLIER, THERE HAVE BEEN SOME ASSURANCES IN THE NEWSPAPER FROM THE COAST GUARD THAT THE REGULATIONS WOULD BE LESS STRINGENT THAN AT PRESENT. SINCE THE COST UNDER THE CURRENT RULES WOULD BE AN ADDITIONAL $100,000,000 PER YEAR, THIS ADVANCE WORD WAS HEARTENING.

THERE ARE ALTERNATIVES TO PAYING ADDITIONAL MONEY FOR ADDED PERSONNEL, BUT THEY ARE NOT WITHOUT SOME COST, EITHER IN DOLLARS OR SACRIFICE OF FERRY SERVICE.

THE ALTERNATIVES WOULD INCLUDE:

- LIMITING THE NUMBER OF PEOPLE ALLOWED ON THE BOATS TO THE CAPACITY OF THE RAFTS CURRENTLY DEPLOYED.

- DRASTICALLY CURTAILING THE NUMBER OF RUNS TO KEEP WITHIN BUDGET.

- MAINTAINING CURRENT SERVICE BY RAISING FARES TO PAY FOR THE ADDITIONAL CREWMEN.

- ASKING THE STATE LEGISLATURE TO INCREASE OUR ANNUAL SUBSIDY OF ABOUT $15 MILLION TO WHATEVER IT TAKES TO MAINTAIN CURRENT SERVICE.

- TRYING TO WORK OUT AN ACCOMMODATION ON THE MANNING ISSUE WITH THE COAST GUARD, THE INLANDBOATMEN'S UNION, AND THE MASTERS, MATES AND PILOTS TO, FIRST, PERMIT US TO CARRY LESS SAILORS DURING NON-COMMUTE HOURS, AND SECOND, TO ENABLE US TO EMPLOY LARGE GROUPS OF DECK EMPLOYEES ON PART-TIME SHIFTS TO COVER THE HEAVY TRAFFIC PERIODS. EVEN USING THIS PART-TIME APPROACH COULD ADD MILLIONS TO ANNUAL LABOR COSTS. THIS WOULD BE A SEVERE ADMINISTRATIVE PROBLEM FOR OUR DISPATCHERS.

OR

- SOME COMBINATION OF THE ABOVE.

NONE OF THE ALTERNATIVES WOULD BE THE LEAST BIT POPULAR, ESPECIALLY RAISING THE FARES OR NOT KEEPING THE SERVICE LEVEL WHERE IT IS TODAY.

I REALIZE THE BILL AS WRITTEN ONLY APPLIES TO OUR STATE FLEET BUT IF THE FEDERAL REGULATIONS THAT RESULT WERE APPLIED NATIONWIDE, THE STATEN ISLAND FERRY SYSTEM IN NEW YORK HAS TWO OF THEIR SEVEN FERRYBOATS WITH CAPACITIES OF 6000 PASSENGERS, SO EACH OF THEM WOULD NEED UP TO 240 RAFTS.

WHEN IT WAS FIRST ANNOUNCED THESE HEARINGS WOULD BE HELD, THERE WAS A FLOOD OF LOCAL NEWSPAPER ARTICLES, TV INTERVIEWS, EDITORIALS, RADIO SPOTS AND OTHER MEDIA COVERAGE, DUTIFULLY REPORTING THE IRRESPONSIBLE RHETORIC COMING FORTH FROM AN ADVOCATE OF 100% RAFTING. THESE UTTERANCES INCLUDED SUCH UNSUBSTANTIATED "SCARE STATEMENTS" AS:

- HUNDREDS WILL DIE
- HANDICAPPED PERSONS WILL BE DEAD MEAT, AND
- OUR FERRYBOATS ARE DEATHTRAPS, UNQUOTE.

I HAVE THE CLIPPINGS AND I MUST SAY THIS WAS A DISGUSTING AND TOTALLY UNWARRANTED ENDICTMENT OF A FERRY SYSTEM WITH AN ENVIABLE SAFETY RECORD GOING BACK 37 YEARS WITHOUT AN ACCIDENT RESULTING IN A SINGLE DEATH OR SERIOUS INJURY. ALL THIS WHILE SAFELY TRANSPORTING OVER 429 MILLION PEOPLE ACROSS THE SOUND.

SADLY, I MUST SAY THE SPOKESMAN HARDLY COVERED HIMSELF WITH DISTINCTION BY PRESENTING HIS SIDE OF THE DEBATE WITH SUCH BLATANT SENSATIONALISM.

UNFORTUNATELY IT WAS THE SAME ONE OF OUR CAPTAINS. BUT, IT HAS BEEN MY EXPERIENCE IN LIFE THAT THE WEAKER THE CASE THE LOUDER AND MORE MELODRAMATIC MUST BE THE ARGUMENTS.

I PURPOSELY CHOSE TO STAY OUT OF THAT GAME AND WAIT FOR THIS HEARING TO LAY MY CARDS ON THE TABLE.

I NEEDN'T TELL A CONGRESSIONAL COMMITTEE THAT NEITHER A LETTER TO THE EDITOR NOR A 30 SECOND TV SPOT IS A SUITABLE FORUM IN WHICH TO GATHER FACTS TO WRITE LAW OR REGULATIONS.

WHEN PROPERLY DONE THE FEDERAL RULE MAKING PROCESS IS THOROUGH, BECAUSE ALL OF THE IMPACTS

- THE SOCIAL
- THE ECONOMIC AND
- THE ENVIRONMENTAL

ARE CONSIDERED. RULEMAKING SHOULD NEVER BE RUSHED UNLESS THERE IS SOME BIG EMERGENCY. IT IS AN ORDERLY SYSTEM AND SHOULD BE CHANGED SLOWLY OR CHAOS CAN RESULT.

I WELCOME YOUR HEARING TODAY, MR. CHAIRMAN, BECAUSE THIS IS THE PROPER TIME TO SET ASIDE THE THEATRICS AND THE RHETORIC THAT HAVE BEEN SO PREVALANT IN CERTAIN QUARTERS AROUND PUGET SOUND THESE PAST FEW WEEKS - AND TO GET THE FACTS AND STATISTICS SEPARATED FROM PERSONAL OPINIONS AND HYPERBOLE.

THERE HAS BEEN INNUENDO, HALF TRUTHS, AND "DAMNING WITH FAINT PRAISE" THAT HAS APPEARED IN PRINT LATELY, SUGGESTING THE WASHINGTON STATE FERRY SYSTEM DOESN'T MEASURE UP TO THE STANDARDS OF SAFETY THAT IT SHOULD.

TO THIS I SAY "POPPYCOCK", THE FERRY SYSTEM MEETS OR EXCEEDS ALL FEDERAL REGULATIONS FOR SAFETY AND THE SPECIFIC REQUIREMENTS LAID DOWN BY THE LOCAL COAST GUARD OFFICE.

SOME FOLKS HAVE AN EASY TIME BELIEVING INNUENDO, ALTHOUGH INNUENDO IS TOUGH TO QUANTIFY AND MEASURE.

THOSE SAME FOLKS OFTEN FIND IT TOUGH TO BELIEVE STATISTICS, ALTHOUGH STATISTICS LEND THEMSELVES EASILY TO BEING MEASURED.

IF THE STATISTICS ARE TO BE BELIEVED, IN THE WASHINGTON STATE FERRY SYSTEM'S 37 YEARS OF SERVICE, WE HAVE NEVER HAD A PASSENGER KILLED OR SERIOUSLY INJURED IN A COLLISION. LUCK? - MAYBE SOME.... BUT AS LEE TREVINO SAID AFTER CHIPPING A GOLF BALL INTO THE CUP FROM OFF THE GREEN - "THE MORE I PRACTICE, THE LUCKIER I GET."

I HOPE I HAVE BEEN ABLE TO SHED SOME LIGHT ON THE SAFETY SYSTEM TODAY AND MAKE CLEAR THAT THERE ARE NO SIMPLE GIMMICKS, NO SHORTCUTS TO SAFETY AT SEA.

IF YOU ASKED MY OPINION ON THE NEED FOR 100% RAFTING:

I WOULD SAY "NO"

BUT CONGRESSMEN, PLEASE DON'T JUST TAKE MY WORD FOR IT.

THERE IS THE OTHER SCHOOL OF THOUGHT REPRESENTED HERE TODAY - IF ASKED THEIR OPINION:

THEY WOULD SAY "YES"

BUT CONGRESSMEN, PLEASE DON'T JUST TAKE THEIR WORK FOR IT EITHER.

IN OUR COUNTRY, WITH FREEDOM OF SPEECH AS THE LAW OF THE LAND, EVERYONE IS ENTITLED TO THEIR OWN OPINION - BUT THEY'RE NOT ENTITLED TO THEIR OWN FACTS.

THERE IS A LOT RIDING ON THIS HEARING TODAY, AND IT MUST BE FACTS, NOT OPINIONS OF SELF-STYLED EXPERTS, THAT SHOULD BE BASIS FOR REGULATIONS.

MR. CHAIRMAN, AGAIN IN MY OPINION, REQUIRING INSTALLATION OF HUNDREDS OF RUBBER RAFTS ON WASHINGTON STATE FERRIES WILL ONLY GIVE A SLIM, IF ANY, EXTRA MARGIN OF SAFETY FOR OUR PASSENGERS AT A TREMENDOUS CAPITAL OUTLAY OF FUNDS FOLLOWED BY AN ANNUAL MAINTENANCE AND PERSONNEL COST THAT STAGGERS THE IMAGINATION.

ANOTHER CONCERN OF YOUR COMMITTEE, MR. CHAIRMAN, IS FATHOMETERS, OR DEPTH SOUNDERS.

THE QUESTION OF DEPTH SOUNDERS HAS BEEN RAISED IN THE PAST, AND THE POSITION OF WASHINGTON STATE FERRIES, SUPPORTED BY THE U.S. COAST GUARD, IS THAT DEPTH SOUNDERS ARE UNNECESSARY FOR USE ABOARD WASHINGTON STATE FERRY VESSELS.

ALL FERRY VESSELS OPERATED BY WSF NAVIGATE OVER WELL DEFINED AND WELL CHARTED ROUTES IN DEEP WATER.

THE SKILL OF OUR MASTERS AND MATES, ENHANCED BY THEIR TRAINING AND EXPERIENCE, AND AIDED BY NAVIGATIONAL DEVICES SUCH A GYRO COMPASSES AND RADAR, ALLOWS THEM TO KEEP CLOSE TRACK OF THEIR POSITION AND TO KEEP THE FERRIES ON THEIR PROPER COURSES AND IN DEEP WATER. IN EACH OF THE GROUNDINGS OF THE FERRIES - WALLA WALLA, ELWHA AND HYAK - THE FERRIES WERE PURPOSELY DIRECTED BY THE WATCH-STANDING OFFICERS FROM THEIR PROPER COURSES. EVEN IF THE AFOREMENTIONED VESSELS HAD BEEN EQUIPPED WITH DEPTH SOUNDERS, THE GROUNDINGS WOULD HAVE OCCURRED.

WSF CONDUCTED MANEUVERING TESTS DURING MARCH, 1984, ABOARD THE FERRY YAKIMA. IT WAS ESTABLISHED DURING THAT TEST THAT STOPPING FROM A SPEED OF 12 KNOTS TAKES 43 SECONDS, DURING WHICH TIME THE BOAT TRAVELLED AN AGERAGE OF 535 FEET. THESE TESTS WERE CONDUCTED WITH BOTH THE MASTER AND CHIEF ENGINEER AT THE CONTROLS, READY TO RESPOND, THEREFORE, THE

RESULTS WERE OPTIMUM. AT 12 KNOTS, EACH SECOND OF TIME TAKEN TO RESPOND TO A DEPTH ALARM UNTIL THE CONTROLS ARE REVERSED ADDS 20 FEET OF SHIP TRAVEL. THUS, 5 SECONDS RESPONSE TIME WOULD ADD 100 FEET TO THE STOPPING DISTANCE. WITH THE STEEP BEACHES AND THE ROCKS THESE FERRIES ENCOUNTER, A DEPTH ALARM, SET FOR THE MINIMUM CHANNEL DEPTH (TO AVOID FALSE ALARMS) WOULD BE OF NO VALUE.

THE COMMANDER, 13TH COAST GUARD DISTRICT IN SEATTLE, IN CORRESPONDENCE WITH WSF, NOTED THE PRIMARY REASON FOR THE COAST GUARD'S CURRENT POSITION (ON FATHOMETERS) IS DUE TO THE FACT THAT FEDERALLY LICENSED FIRST CLASS PILOTS THAT OPERATE ALL STATE FERRIES ARE TESTED IN DETAIL ON EVERY FACET OF THE FERRY ROUTES BEFORE BEING ISSUED A PILOT'S ENDORSEMENT ON THEIR LICENSE. ONCE QUALIFIED, THEY RUN THEIR ROUTES MANY HUNDREDS OF TIMES, DEALING WITH EVERY NUANCE OF CURRENT AND CHARACTER OF THE BOTTOM. IN THE FEW INSTANCES WHEN A FERRY GROUNDING DID OCCUR, THE COAST GUARD'S DETAILED INVESTIGATION REPEATEDLY SHOWED THE PRESENCE OF ABSENCE OF DEPTH RECORDING DEVICES WAS NOT EVEN A FACTOR IN ANY OF THE INCIDENTS.

IN AN EFFORT TO HELP THE COMMITTEE UNDERSTAND WHAT IS INVOLVED IN MAKING A DEPTH RECORDING DEVICE FUNCTIONAL AND EFFECTIVE IN ITS USE ON A DOUBLE ENDED FERRY VESSEL, THE FOLLOWING IS OFFERED:

IN ORDER FOR DEPTH SOUNDER TRANSDUCER TO BE EFFECTIVE, IT MUST BE

INSTALLED AS CLOSE TO THE FORWARD PART OF THE VESSEL AS POSSIBLE*. DEPTH SOUNDERS AVAILABLE TO WSF ARE SENSITIVE TO FISH, KELP, CURRENT SHEAR PLANES, AERATED WATER AND TURBULENCE, AS WELL AS TO THE BOTTOM. THE TRANSDUCER LOCATION IS CRITICAL TO AVOID THE EXTRANEOUS EFFECTS OF AERATION AND WATER TURBULENCE NEAR THE HULL. THE ONLY PLACE ON ANY OF OUR DOUBLE-ENDED FERRIES WHERE A TRANSDUCER MAY BE INSTALLED AND HAVE ACCESS FOR SERVICING AND CABLE RUN IS WELL BACK FROM THE END, CLEAR OF THE STERN TUBE AREA.

DUE TO THE CONFIGURATION OF OUR VESSELS, WITH PROPELLERS ON EACH END, A LARGE AMOUNT OF TURBULENCE IS CREATED, CAUSING THE DEPTH SOUNDER TO BE OF NO USE TO OUR MASTERS, FOR PROVIDING THE NECESSARY INFORMATION REQUIRED TO ACCURATELY DETERMINE THE CONTROLLED DEPTH IN WHICH OUR VESSELS OPERATE.

THE FOLLOWING TABULATION INDICATES THE APPOROXIMATE COST OF INSTALLATION OF DEPTH SOUNDERS ABOARD A FERRY VESSEL.

INITIAL PURCHASE OF DEPTH SOUNDER: $300 to $30,000

(FROM THE LEAST COMPLICATED TO MOST SOPHISTICATED)

INSTALLATION (WHICH INCLUDES THE FOLLOWING): $30,000

1. TRANSDUCER PLATFORM CONSTRUCTION
2. COFFER DAM CONSTRUCTION; AND
3. WIRE RUN

* Attached is a profile drawing of a ferry showing where a naval architect would locate the instrument.

DRY DOCK FOR TRANSDUCER INSTALLATION:	$40,000
AVERAGE TOTAL COST PER VESSEL:	$90,000

WHEN THIS MATTER WAS DREDGED UP AGAIN AND MADE A SUBJECT OF A HEARING BEFORE THE WASHINGTON STATE SENATE TRANSPORTATION COMMITTEE JUST LAST YEAR, THE FERRY SYSTEM WAS SURPRISED. THE COMMITTEE TOOK TESTIMONY IN FAVOR OF BUYING THEM FROM THE SAME FERRY CAPTAIN THAT ADVOCATES 100% RAFTING. IN REBUTTAL THE FERRY SYSTEM OPERATIONS SUPERINTENDENT TESTIFIED AS TO THEIR LIMITED CAPABILITY AND USEFULLNESS.

THE SENATE COMMITTEE UNANIMOUSLY REJECTED THE SALES PITCH AND WSF THOUGHT THE MATTER FINALLY CONCLUDED UNTIL WE WERE ADVISED THE CONGRESSIONAL COMMITTEE HAD IT ON THIS AGENDA. WE WONDER HOW MANY "BITES AT THE APPLE" THIS STATE EMPLOYEE IS ENTITLED TO AND WHAT IS HIS NEXT "COURT OF APPEAL" AFTER THE U.S. CONGRESS, IF YOU TURN HIM DOWN.

IN CONCLUSION, LET ME STRESS THAT IF DEPTH SOUNDERS COULD PREVENT ACCIDENTS ABOARD OUR VESSELS, WE WOULD PROCURE THEM. HOWEVER, IT IS THE PROFESSIONAL OPINION OF FERRY SYSTEM STAFF AND THE U.S. COAST GUARD, THAT DEPTH SOUNDERS TODAY WOULD SERVE NO USEFUL PURPOSE ABOARD A DOUBLE ENDED FERRY IN THE WASHINGTON STATE FLEET.

HWP:br
98-12:1759

PHILIP F. SPAULDING
TESTIMONY BEFORE
CONGRESSIONAL COMMITTEE

GOOD AFTERNOON MR. CHAIRMAN, MEMBERS. FOR THE RECORD I AM PHILIP F. SPAULDING OF SEATTLE, WASHINGTON AND A REGISTERED NAVAL ARCHITECT.

EVERYTIME THERE IS A COLLISION, A DISASTER AT SEA OR EVEN A MINOR INCIDENT INVOLVING SHIPS, A SERIES OF ARTICLES APPEAR IN THE NEWSPAPER ALLUDING TO THE TITANIC DISASTER, WHICH OCCURRED 76 YEARS AGO. THESE SERVE TO CREATE AN IMPRESSION THAT THERE HAS BEEN NO ADVANCEMENT IN THE FIELD OF NAVAL ARCHITECTURE, NOR ANY MORE CONCERN FOR THE SAFETY OF SHIP'S PASSENGERS THAN EXISTED AT THAT TIME. AFTER THE TITANIC CATASTROPHY, THERE HAVE BEEN A MULTITUDE OF INTERNATIONAL CONVENTIONS HELD ON THE SUBJECT "SAFETY OF LIFE AT SEA", AND THE OUTCOME OF ALL OF THIS HAS RESULTED IN MODERN LAWS MAKING SHIPPING THE SAFEST MODE OF TRANSPORTATION IN THE WORLD.

PASSENGER CARRYING SHIPS, AS WELL AS THE LARGE WASHINGTON STATE FERRIES, ARE NOW DESIGNED SO THEY ARE COMPARTMENTED BELOW THE FREEBOARD DECK TO SUCH AN EXTENT THAT IF ANY TWO COMPARTMENTS WERE TO BE FLOODED COMPLETELY, THE VESSELS WOULD REMAIN AFLOAT IN AN UPRIGHT POSITION.

I WILL ADMIT THAT NO SHIP IS UNSINKABLE; HOWEVER, IT WOULD TAKE AT LEAST TWO OR PERHAPS THREE EXPLOSIVE TORPEDOES STRATEGICALLY AIMED TO SINK ONE OF THE WASHINGTON STATE FERRIES AS THEY ARE PRESENTLY DESIGNED. THIS POSSIBILITY, I THINK, ALL WILL AGREE IS HIGHLY UNLIKELY.

TO PROVE THE VALIDITY OF THE U.S. COAST GUARD SUBDIVISION REQUIREMENTS, ONE MUST LOOK AT THE EXPERIENCE OF THE ALASKA MARINE HIGHWAY. EVERY DAY THESE VESSELS PASS THROUGH HAZARDOUS CHANNELS, AND ARE CONFRONTED WITH EXTREME TIDAL CURRENTS DURING THEIR NORMAL OPERATION. THROUGH THE YEARS, THERE HAVE BEEN SURPRISINGLY FEW ACCIDENTS; HOWEVER, IN EACH CASE WHEN A SHIP WENT AGROUND, SHE DID NOT SINK OR CAPSIZE. IN EACH CASE, THE VESSEL RETURNED TO SEATTLE FOR DRYDOCKING UNDER ITS OWN POWER. IN ONE CASE, THE BOTTOM OF THE VESSEL WAS DAMAGED FOR A LENGTH OF 137 FEET.

CONCERNING FIRE SAFETY, IN 1934 THE SS MORRO CASTLE BURNED OFF THE NEW JERSEY COAST WITH THE LOSS OF 124 LIVES. THIS CATASTROPHY PROMPTED THE U.S. SENATE TO CONDUCT AN INTENSIVE INQUIRY INTO THE CAUSE OF THE DISASTER, AND TO ESTABLISH RULES FOR CONSTRUCTING PASSENGER SHIPS, SO THIS TYPE OF DISASTER WOULD NEVER OCCUR AGAIN. THE RESULTING REPORT WAS KNOWN AS SENATE REPORT 184. THE U.S. COAST GUARD HAS BEEN CHARGED WITH THE RESPONSIBILITY FOR ADMINISTERING THE LAW AND SEES TO IT THAT ALL AMERICAN BUILT VESSELS COMPLY FULLY AND ARE OF FIRE PROOF CONSTRUCTION.

IT IS ONLY RECENTLY THAT THE U.S. COAST GUARD RULES FOR FIREPROOF CONSTRUCTION HAVE BEEN ADOPTED BY THE INTERNATIONAL MARITIME ORGANIZATION (IMO). IMO IS AN INTERNATIONAL GOVERNING BODY, WHICH SETS CONSTRUCTION STANDARDS FOR ALL FOREIGN BUILT PASSENGER CARRYING VESSELS. THE STATEMENT THAT THERE ARE TONS OF BURNABLE PLASTICS ON

THE WASHINGTON STATE FERRIES IS COMPLETELY UNTRUE. ALL MATERIALS USED IN THE CONSTRUCTION OF THESE VESSELS ARE EITHER FIREPROOF OR FIRE RESISTANT, AND WILL NOT SUPPORT FLAME SPREAD, WHICH IS A DIRECT REQUIREMENT OF THE U.S. COAST GUARD.

IF ONE WERE TO TAKE NOTE OF ANY PLACE ON THE VESSELS WHERE THERE IS A POSSIBILITY OF AN UNDETECTED FIRE STARTING, THAT SPACE IS COMPLETELY SURROUNDED WITH INSULATED FIREPROOF BULKHEADS AND FITTED WITH FIRE DOORS. ALSO, IF THE SPACE CARRIES INFLAMMABLE LIQUIDS OR MATERIALS, THERE IS AN AUTOMATIC FIRE DETECTION SYSTEM INSTALLED AS WELL.

IF A FIRE WERE TO START IN THE GALLEY, ALL OF THE SURROUNDING BULKHEADS AND DECKS ARE INSULATED AND FIREPROOF. IN ADDITION, ALL DOORS ARE FIRE DOORS, AND DOUBLE ROLL-DOWN FIRE CURTAINS ARE FITTED IN WAY OF THE SERVING LINE. THE GREASE TRAPS IN THE RANGE HOODS ARE FITTED WITH AN AUTOMATIC FIRE EXTINGUISHING SYSTEM. PORTABLE FIRE EXTINGUISHERS ARE ALSO FITTED IN THE GALLEY, AS WELL AS THROUGHOUT THE VESSEL IN OTHER ESSENTIAL AREAS AND STRATEGIC LOCATIONS.

THROUGHOUT THE PASSENGER AREAS AND ELSEWHERE IN THE VESSELS THERE ARE FIRE STATIONS WITH 1½" - 2½" HOSES FIFTY FEET LONG AND OF SUCH NUMBER AND LOCATION THAT AT LEAST TWO STREAMS OF WATER CAN BE DIRECTED ON ANY SPOT WITHIN THE AREA AT THE SAME TIME.

EACH PASSENGER AREA IS SEPARATED BY INSULATED STEEL FIREPROOF BULKHEADS TO THE HIGHEST FIRE RATING, TOGETHER WITH SELF-CLOSING FIRE DOORS WHICH EFFECTIVELY DIVIDE THE PASSENGER AREAS INTO SAFETY ZONES.

THE DIESEL FUEL ON THE VESSEL IS ALL CONTAINED WITHIN STEEL TANKS. THE ONLY DANGER OF FIRE WITHIN THESE ENCLOSED TANKS WOULD BE FROM THEIR VENTING AND ALL OF THE VENTS ARE FITTED WITH FLAMEPROOF SCREENS.

IN THE REMOTE POSSIBILITY THAT A FIRE SHOULD DEVELOP IN THE MACHINERY SPACES ON THE SHIP, THE FIRE WOULD BE EXTINGUISHED BY A FIXED REMOTELY CONTROLLED CARBON DIOXIDE OR HALON SUPPRESSION SYSTEM. THE OVERHEAD IN THE MACHINERY SPACES IS ALSO FIRE INSULATED TO PREVENT THE STEEL VEHICLE DECK PLATING OVERHEAD GETTING HOT ENOUGH TO DAMAGE VEHICLE TIRES OR POSSIBLY SET OFF A GASOLINE FIRE IF THERE WERE ANY GASOLINE SPILLED ON THE VEHICLE DECK.

IN EACH OF THE VEHICLE SPACES A DELUGE WATER SPRINKLER SYSTEM HAS BEEN INSTALLED OVERHEAD WHICH IS OF SUFFICIENT CAPACITY TO COMPLETELY DROWN A VEHICLE FIRE. IN ADDITION, THE STEEL PASSENGER DECK OVERHEAD OF THE VEHICLE SPACE IS FIRE INSULATED TO THE HIGHEST FIRE RATING. THE VEHICLE DECKS ARE OPEN AT EACH END AND ALONG EACH SIDE TO PROVIDE VENTILATION TO CARRY AWAY ANY "HEAT AND NOXIOUS FUMES" IN THE REMOTE POSSIBILITY THAT THEY MIGHT BE GENERATED.

ELECTRICALLY DRIVEN FIRE PUMPS ARE LOCATED BOTH INSIDE AND OUTSIDE OF THE MACHINERY SPACES WHICH ARE ENERGIZED BY EITHER OF TWO DIESEL GENERATING SETS LOCATED IN THE ENGINE ROOM OR BY AN EMERGENCY DIESEL GENERATOR LOCATED HIGH ON THE SUN DECK WITHIN A FIRE PROTECTED SPACE.

ALL OF THESE SYSTEMS ARE ROUTINELY TESTED TO PROVE THEIR READINESS FOR SERVICE. PART OF CREW TRAINING IS TO ACQUAINT THEM WITH A "HANDS ON" EXPERIENCE ON THE USE OF ALL SAFETY EQUIPMENT THROUGHOUT THE VESSEL.

IN THE VIRTUALLY IMPOSSIBLE POSSIBILITY OF A FIRE ON BOARD A FERRY THE SAFEST PLACE FOR A PASSENGER TO BE IS WITHIN THE PASSENGER AREAS WHICH ARE COMPLETELY INCAPSULATED WITHIN A FIREPROOF STRUCTURE, THEN LET THE TRAINED CREW FIGHT THE FIRE WITH THE ADEQUATE EQUIPMENT THEY HAVE AT HAND.

AGAIN I WOULD LIKE TO STRESS THE FACT THAT THE VESSELS HAVE BEEN DESIGNED TO BE SO SAFE THAT THEY ARE THEIR OWN LIFEBOATS INSOFAR AS SINKING AND CAPSIZING ARE CONCERNED. ALSO, THE VESSELS HAVE BEEN BUILT OF FIREPROOF CONSTRUCTION AND ATTENTION PAID TO ALL POTENTIAL FIRE HAZARDS WITH PROPER MEASURES TAKEN TO PROTECT PASSENGERS AT ALL COSTS.

THE RECORD SPEAKS FOR ITSELF. THERE HAS NEVER BEEN A LOSS OF LIFE ON A WASHINGTON STATE FERRY RESULTING FROM SINKING, CAPSIZING OR FIRE AND THAT IS NOT PURE LUCK.

ADDRESSING THE MUCH DISCUSSED SUBJECT OF LIFEBOATS OR LIFE RAFTS WITH CAPACITY FOR ALL HANDS, THE HIGH DEGREE OF SAFETY BUILT INTO THE VESSELS, TOGETHER WITH THE FACT THAT ALL FERRY ROUTES ARE

COMPARATIVELY SHORT IN PROTECTED WATERWAYS WHERE THERE IS A HIGH INCIDENT OF VESSEL TRAFFIC AND WHERE AID COULD BE GIVEN IN A VERY SHORT TIME SHOULD THE NECESSITY ARISE. TO REITERATE -- THE VESSELS ARE DESIGNED SO THAT THEY ARE THEIR OWN LIFEBOATS.

THE LIFE RAFTS AND RESCUE BOATS PROVIDED ON THE VESSEL ARE FOR THE SPECIFIC PURPOSE TO RETRIEVE ANYONE FALLING OVERBOARD OR RENDERING ASSISTANCE TO ANOTHER SMALL VESSEL IN TROUBLE.

IMAGINE THAT EACH FERRYBOAT WAS EQUIPPED WITH LIFEBOATS OR LIFE RAFTS FOR ALL PERSONS ON BOARD. THE RATIO OF QUALIFIED LIFEBOATMEN FOR EITHER INFLATABLE LIFE RAFTS OR LIFEBOATS IS APPROXIMATELY ONE LIFEBOATMAN PER 25 PASSENGERS. THE JUMBO FERRIES AND THE SUPER FERRIES WITH THEIR 2,500 PERSON CAPACITIES WOULD REQUIRE A CREW OF 100 QUALIFIED LIFEBOATMEN.

THERE HAS BEEN ALTOGETHER TOO MUCH SPECULATIVE AND THEORIZING BY PEOPLE WHO DO NOT KNOW THE FACTS AND WHO HAVE GENERATED SCARE TACTICS THROUGH THE MEDIA BECAUSE OF THEIR SELF ACCLAIMED EXPERTISE. THE REAL RESPONSIBLE EXPERTS IN THE MARINE FIELD ARE THE U.S. COAST GUARD, THE CLASSIFICATION SOCIETY SURVEYORS AND WASHINGTON STATE FERRY SYSTEM'S PROFESSIONALLY TRAINED STAFF WHO HAVE A LIFELONG MARITIME BACKGROUND.

THANK YOU FOR THE OPPORTUNITY TO TESTIFY.

BB-12:1800

J. E. DE CARTERET
CONGRESSIONAL TESTIMONY BEFORE
CONGRESSIONAL SUBCOMMITTEE
31 MAY 1988

GOOD AFTERNOON MR. CHAIRMAN, FOR THE RECORD I AM JOHN DE CARTERET, MARITIME CONSULTANT AND A RETIRED CAPTAIN FROM THE UNITED STATES COAST GUARD. I AM VERY FAMILIAR WITH THE COAST GUARD RULES AND REGULATIONS AND THEIR DEVELOPMENT.

THE DEVELOPMENT OF REGULATIONS IS A DIFFICULT PROCESS. WHILE WORKING IN THE FIELD OF REGULATORY DEVELOPMENT, I HAVE ALWAYS LOOKED AT THE ANATOMY OF A REGULATION AS HAVING SEPARATE PARTS. FIRST, IS THEREGULATION NECESSARY (DOES IT DO SOMETHING TO ENHANCE SAFETY). SECOND, DOES IT ACCOMPLISH WHAT IT PURPORTS TO DO. THIRD, EVEN THOUGH IT SUPPOSEDLY ENHANCES SAFETY WILL IT SAVE ANY LIVES. THE LAST QUESTION IS THE COST/BENEFIT REASONABLE OR ARE WE GOING TO SPEND MILLION OF DOLLARS TO SAVE ONE LIFE OVER A PERIOD OF TEN YEARS. THE LAST QUESTION IS THE HARDEST TO ANSWER, WHAT VALUE IS TO BE PLACED ON A HUMAN LIFE. HOWEVER, DECISIONS HAD TO BE MADE AND SENSIBLE REGULATIONS WERE PUBLISHED. HOWEVER, SOME AREAS THAT HAVE NEEDED REGULATION FOR YEARS HAVE BEEN IGNORED. THE LOSS OF LIFE FROM FISHING VESSEL ACCIDENTS IS ONE AREA WHERE NOTHING HAS BEEN DONE. DURING THE PERIOD OF FOUR YEARS THAT I WAS STATIONED HERE IN SEATTLE ABOUT 40 WASHINGTON STATE RESIDENTS LOST THEIR LIVES IN FISHING VESSEL ACCIDENTS. IT IS THE MOST DANGEROUS OCCUPATION IN THE UNITED STATES, BUT NOTHING HAS BEEN DONE ABOUT IT. A FEW CONGRESSIONAL INQUIRIES WERE HELD AND MUCH WAS SAID, BUT NOTHING WAS DONE. YET, HERE WE ARE INVESTIGATING A

SYSTEM THAT HAS CARRIED MILLIONS OF PASSENGERS OVER THOUSANDS OF MILES EACH YEAR WITHOUT THE LOSS OF A SINGLE LIFE. ANOTHER QUESTION THAT SHOULD BE ANSWERED IS, IF THE LIFE RAFTS ARE BELIEVED NECESSARY ON THE LARGE FERRY BOATS THAT HAVE GOOD STABILITY AND SUBDIVSION, THEN WHAT ABOUT THE SMALL PASSENGER VESSELS THAT ARE LACKING THE SAME SUBDIVISION AND STABILITY AND OPERATE OVER THE SAME WATERS? IT WOULD APPEAR THAT THESE VESSELS ARE MORE IN NEED OF THE RAFTS, THAN THE LARGE PASSENGER AND FERRY VESSELS. ALSO WHAT ABOUT ALL OF THE OTHER VESSELS THROUGHOUT THE UNITED STATES THAT OPERATE ON LAKES, BAYS AND SOUNDS. THE PASSENGERS ON THESE SHOULD BE AFFORDED EQUAL PROTECTION. THESE ARE QUESTIONS THAT MUST BE ANSWERED, BECAUSE IF YOU FEEL THAT THE WASHINGTON STATE FERRIES ARE UNSAFE, THEN THE REST OF THESE SMALLER VESSELS SHOULD BE CLASSIFIED AS FLOATING DISASTERS.

SAFETY IS A SYSTEM COMPOSED OF THREE GROUPS; THE REGULATORY BODIES, THE OWNERS OF THE TRANSPORTATION SYSTEMS AND THE PEOPLE WHO OPERATE THE VESSELS. ONE CAN FURTHER DIVIDE THE SAFETY SYSTEM INTO THREE PHASES, THE FIRST IS WHAT I CALL THE PREOPERATIONAL PHASE. IT IS IN THIS PHASE THAT THE REGULATORY BODIES AND DESIGNERS PLAY THE MOST IMPORTANT ROLE. IN THE CASE OF VESSELS, THIS IS WHERE THE COAST GUARD AND NAVAL ARCHITECT ASSURE THAT THE VESSEL HAS THE PROPER STABILITY, THAT IT IS BUILT ACCORDING TO APPROVED PLANS, AND IS SUFFICIENTLY MANNED BY A CREW COMPETENT TO CARRY OUT THEIR DUTIES. THE SECOND PHASE OF THE SAFETY SYSTEM IS WHERE THE OWNERS OF THE VESSELS AND THE CREWS OPERATING THEM, PLAY THE MAJOR ROLES. DURING THIS PHASE THE

OWNERS ARE RESPONSIBLE FOR THE MAINTENANCE AND UPKEEP OF THE VESSEL AND THE CREWS FOR ITS SAFE OPERATION. THE COAST GUARD IS STILL IN THE PICTURE. HOWEVER, ON SOME VESSELS IT APPEARS FOR AN INSPECTION ONLY ONCE A YEAR. ON THE WASHINGTON STATE FERRIES THE COAST GUARD SHOULD GIVE THE VESSELS A MAJOR INSPECTION YEARLY AND THREE MINOR REINSPECTIONS DURING THE YEAR. AS YOU CAN SEE THE MAJOR ROLE IN THE MAINTENANCE OF THE SAFETY ENVELOPE FALLS ON THE OPERATORS OF THE VESSEL, THAT IS THE OWNERS AND THE CREW. THE THIRD PHASE OF THE SAFETY SYSTEM I WILL GET BACK TO LATER IN MY TESTIMONY.

THE FIRST AND SECOND PHASES OF THE SAFETY SYSTEM ARE THE MOST IMPORTANT. BECAUSE IF THESE TO OPERATE AS THEY ARE SUPPOSE TO THEN THE THIRD PHASE NEVER COMES INTO PLAY. THE MOST IMPORTANT PART PLAYED IN THE OVERALL SAFETY PICTURE IS THAT ROLE BETWEEN THE NAVEL ARCHITECT AND COAST GUARD, THE INTERFACE WHICH TAKES PLACE EVEN BEFORE CONSTRUCTION OF THE VESSEL BEGINS. THIS IS WHEN THE VITAL BASICS OF SAFETY WHICH CAN NEVER BE DUPLICATED LATER ARE DESIGNED INTO THE SHIP. THESE INCLUDE STRUCTURAL FIRE PROTECTION, FIRE LOADING, SUBDIVISION, INTACT STABILITY AND DAMAGED STABILITY. IN THE CASE OF FERR VESSELS THIS INTERFACE IS EXTREMELY IMPORTANT. FIRST, THE NAVAL ARCHITECT DESIGNS INTO THE VESSEL ALL OF THE REQUIRED SAFETY FEATURES, THEN HIS PLANS ARE REVIEWED AND APPROVED BY EITHER THE AMERICAN BUREAU OF SHIPPING (ABS) OR THE COAST GUARD. THE COAST GUARD HAS ALLOWED THE ABS TO TAKE OVER THE MAJORITY OF PLAN APPROVAL FOR SUCH THINGS AS HULL STRUCTURE, PIPING, ELECTRICAL AND ETC. HOWEVER, ONE

THING THAT THE COAST GUARD STILL RETAINS IS THE OVERSIGHT AND APPROVAL OF SUBDIVISION AND STABILITY. THESE ARE PERHAPS THE MOST IMPORTANT ITEMS IN A VESSELS ABILITY TO SURVIVE EITHER A GROUNDING OR COLLISION. THE MODERN FERRY VESSEL HAS A MINIMUM OF TWO COMPARTMENT SUBDIVISION, IN OTHER WORDS THE TWO LARGEST COMPARTMENTS ON THE VESSEL COULD FLOOD COMPLETELY AND THE VESSEL WOULD STILL FLOAT IN AN UPRIGHT AND STABLE CONDITION.

IN THE CASE OF A FERRY VESSEL THERE ARE THREE ITEMS THAT ARE WATCHED VERY CLOSELY BY THE COAST GUARD, THESE ARE SUBDIVISION, INTACT STABILITY AND DAMAGED STABILITY. I KEEP COMING BACK TO THESE THREE BECAUSE THESE ARE THE BUILT IN FACTORS THAT ARE GOING TO ALLOW THE VESSEL TO SURVIVE AND THUS SAVE LIVES IN THE EVENT OF AN ACCIDENT. THERE ARE OTHER BUILT IN FACTORS THAT AID IN VESSEL SURVIVABILITY IN THE CASE OF FIRE OR OTHER MISHAPS. YOU WILL NOTE THAT I KEEP TALKING ABOUT VESSEL SURVIVABILITY FOR IF THE VESSEL STAYS AFLOAT THEN THE PASSENGERS WILL BE SAFE. I KNOW ONE OF THE QUESTIONS THAT PROBABLY COMES INTO YOUR MIND IS CAN A FERRY VESSEL SINK? QUITE HONESTLY GENTLEMEN ANY VESSEL CAN SINK. HOWEVER, PASSENGER VESSELS ARE DESIGNED TO SURVIVE MAJOR DAMAGE AND HAVE DONE SO IN MANY INSTANCES. SOME OF THE WASHINGTON STATE FERRIES COULD BE SLICED IN HALF AND BOTH PIECES WOULD CONTINUE TO FLOAT AND HAVE ADEQUATE STABILITY TO REMAIN UPRIGHT WITH NO WORRIES ABOUT THE VESSEL CAPSIZING. THE BEST SURVIVAL PLATFORM IS THE VESSEL ITSELF. IN MANY INSTANCES VESSELS HAVE BEEN FOUND AFLOAT AFTER THEIR CREWS HAVE ABANDONED THEM, AND THE CREWS WERE NEVER SEEN OR HEARD FROM AGAIN. IF THEY WOULD HAVE STAYED WITH THE VESSEL THEY WOULD HAVE SURVIVED.

THE SECOND PHASE OF VESSEL SAFETY IS THE OPERATIONAL PHASE. AFTER ALL OF THE SAFETY FEATURES HAVE BEEN DESIGNED INTO A VESSEL, IF IT IS NOT MAINTAINED AND OPERATED IN A SAFE MANNER, THEN THOSE SAFETY FEATURES WILL BE PUT TO SOME SEVERE TESTS DURING THE VESSELS LIFETIME. WHAT I MEAN BY THIS IS THAT NO VESSEL IS DESIGNED TO BE RUN ON THE ROCKS OR INTO A DOCK AT FULL SPEED, ALTHOUGH A COUPLE OF THE WASHINGTON STATE FERRIES HAVE HAD THIS DONE TO THEM AND HAVE SURVIVED WITH RELATIVELY MINOR DAMAGE. ONE MUST ASSUME THAT THE FERRY VESSEL MASTERS, PILOTS AND OTHERS NAVIGATING PUGET SOUND ARE COMPETENT AND WILL OBEY THE RULES OF THE ROAD. ANOTHER PART OF THE OPERATIONAL PHASE OF SAFETY ARE ITEMS SUCH AS BRIDGE TO BRIDGE COMMUNICATIONS WHERE A PILOT ON ONE VESSEL CAN TALK TO THE MASTER OR PILOT ON ANOTHER VESSEL AND MAKE PASSING ARRANGEMENTS. NO LONGER DOES ONE HAVE TO RELY SOLELY ON WHISTLE SIGNALS AND BEING CLOSE ENOUGH TO THE OTHER VESSEL FOR THOSE SIGNALS TO BE HEARD. RADAR IS ALSO PART OF THE OPERATIONAL PHASE ALLOWING THE OFFICERS NAVIGATING VESSELS TO SEE THROUGH FOG AND RAIN. PLUS SHORE BASED RADAR, MANNED BY COAST GUARD PERSONNEL, TRACK AND COMMUNICATE WITH VESSELS AS THEY MAKE THEIR WAY IN, OUT AND ACROSS PUGET SOUND. IF ALL OF THE PEOPLE INVOLVED IN THESE OPERATIONS ARE COMPETENT THERE SHOULD BE NO COLLISIONS OR LOSS OF LIFE. IT HAS BEEN PROVEN THAT VERY FEW ACCIDENTS ARE CAUSED BY MECHANICAL FAILURE, MOST ARE CAUSED BY HUMAN ERROR. BUT IN THIS CASE IT WOULD REQUIRE THE FAILURE OF AT LEAST TWO OR MORE HUMAN BEINGS AT THE SAME TIME. THUS FAR WE HAVE HAD A GOOD SAFETY SYSTEM.

NOW I WILL ADDRESS THE THIRD PAHSE OF SAFETY THAT SOME LIKE TO CALL THE ABANDONMENT PHASE, WHICH HAPPENS AFTER EVERYTHING ELSE HAS FAILED TO WORK. THIS IS MORE CORRECTLY CALLED THE SURVIVAL PHASE. BECAUSE AFTER YOU HAVE COME THIS FAR AND THE VESSEL IS SINKING, YOU ARE NOT TRYING TO JUST ABANDON SHIP, YOU ARE TRYING TO SURVIVE. SOME PEOPLE CALL LIFE JACKETS, LIFEBOATS AND LIFE RAFTS SAFETY EQUIPMENT, THEY ARE NOT, THEY ARE SURVIVAL EQUIPMENT. WHEN ONE REACHES THE STAGE WHERE SURVIVAL EQUIPMENT IS USED LIVES HAVE USUALLY ALREADY BEEN LOST AND MORE ARE PROBABLY GOING TO BE LOST. IN THE EVENT OF CATASTROPHIC ACCIDENTS WHERE A VESSEL SINKS IN A FEW MINUTES, SURVIVAL EQUIPMENT IS VIRTUALLY USELESS, BECAUSE VERY FEW PROPLE ESCAPE FROM THE INTERIOR OF A VESSEL. IN MOST CASES WHERE A VESSEL HAS BEEN SUCCESSFULLY ABANDONED, IT IS BECAUSE THE VESSEL HAS FLOATED FOR AT LEAST HALF AN HOUR OR LONGER AND THERE HAS BEEN TIME TO LAUNCH LIFEBOATS AND LIFE RAFTS. YOU WILL NOTE GENTLEMEN THAT I SAID LAUNCH THESE VEHICLES. NOT THROW THE RAFT OVER THE SIDE AND THEN JUMP INTO FIFTY DEGREE WATER WEARING A LIFE JACKET AND THEN ATTEMPT TO CLIMB INTO THEM. THE COAST GUARD HAS DONE SOME EXPERIEMENTS WITH PEOPLE IN COLD WATER, HAVING TO SWIM TO AND THEN ATTEMPT TO BOARD A LIFE RAFT. THESE WERE FILMED AND THE RESULTS WERE NOT GOOD AS MOST OF THE SURVIVORS COULD NOT BOARD THE RAFTS AFTER THEY WERE IN THE WATER FOR A SHORT PERIOD OF TIME. ANOTHER, MENTIONED SCENARIO IS TO HAVE PEOPLE CLIMB DOWN LADDERS TO REACH THE RAFTS. CAN YOU IMAGINE A SEVENTY YEAR OLD PERSON CLIMBING DOWN A SIXTY FOOT ROPE LADDER HANGING OVER THE SIDE OF A FERRY VESSEL? SOME HAVE SUGGESTED THAT

THE RAFTS COULD BE PULLED AROUND TO THE ENDS OF THE FERRY AFTER LAUNCHING AND PERSONNEL COULD BOARD FROM THESE AREAS. ONCE AGAIN ONLY THREE OR FOUR RAFTS CAN BE BROUGHT TO THESE AREAS AT A TIME AND THE PEOPLE LEAVING THE VESSEL STILL HAVE TO CLIMB DOWN A LADDER TO GET INTO THEM SAFELY. THIS ACCORDING TO SOME PEOPLE IS ONE WAY TO ABANDON A FERRY VESSEL, BUT WITH A FULL LOAD OF TWENTY FIVE HUNDRED PASSENGERS THIS COULD TAKE HOURS.

LAUNCHABLE RAFTS ARE THE ONLY SAFE WAY TO ABANDON A SHIP, AND IN ORDER TO GET 2,500 PEOPLE INTO RAFTS AND OVER THE SIDE THE VESSEL IS GOING TO HAVE TO FLOAT IN AN UPRIGHT POSITION FOR OVER HALF AN HOUR AFTER THE ABANDONMENT OPERATION IS STARTED. THIS WOULD MEAN THAT ONE HUNDRED RAFTS WOULD HAVE TO BE LAUNCHED IN THIRTY MINUTES, THE TIME ALLOWED BY COAST GUARD REGULATIONS. WITH THIRTY FOUR DAVITS WORKING THIRTY FOUR RAFTS CONTAINING 850 PERSONS WOULD HAVE TO BE LAUNCHED EVERY TEN MINUTES. IN ORDER TO ACCOMPLISH THIS MANY ADDITIONAL CREWMEN WOULD BE REQUIRED. FURTHER, COAST GUARD REGULATIONS IN 46 CFR 78.14-5 (B) REQUIRE A QUALIFIED PERSON FOR EACH LIFE RAFT WHETHER IT IS LAUNCHABLE OR NOT. THIS REQUIREMENT HAS BEEN IN PLACE FOR YEARS AND IS NECESSARY TO SAFELY ABANDON SHIP BY USING LIFE RAFTS. THIS REQUIREMET COULD ADD UP TO 100 ADDITIONAL CREWMEN ON EACH LARGE VESSEL AND THEY WOULD BE NECESSARY TO SUCCESSFULLY ABANDON A VESSEL IN THE REQUIRED TIME.

THIS IS WHY VESSELS ARE DESIGNED WITH SUBDIVISION AND STABILITY BUILT INTO THE, BECAUSE THEY HAVE TO SURVIVE FOR A PERIOD OF TIME IN ORDER TO BE ABANDONED SAFELY. BY THIS TIME HERE IN PUGET SOUND OTHER VESSELS WOULD HAVE ARRIVED AND REMOVED THE PEOPLE FROM THE SINKING VESSEL.

JUST HOW GREAT ARE THE CHANCES OF AN ACCIDENT THAT WOULD SEVERELY DAMAGE A FERRY VESSEL HERE IN PUGET SOUND? LET US LOOK AT SOME COAST GUARD STATISTICS. THE MAJORITY OF VESSELS MOVEMENTS ARE THOSE OF THE FERRY VESSELS THEMSELVES, APPROXIMATELY 419 PER DAY ACCORDING TO VTS STATISTICS. ON THE OTHER HAND, FREIGHT VESSELS OR TANK VESSELS LARGE ENOUGH TO CAUSE MAJOR DAMAGE TO A FERRY VESSEL ONLY AVERAGE APPROXIMATELY 34 VESSEL MOVEMENTS PER DAY AND SOME OF THESE MOVEMENTS ARE ONLY BETWEEN PIERS IN THE SAME PORT. EVERY VESSEL ENTERING PUGET SOUND DOES NOT GO TO TACOMA OR OLYMPIA, THEREBY CROSSING EVERY FERRY ROUTE. WE ALL KNOW THAT A LARGE NUMBER OF THE TANK VESSELS GO TO ANACORTES OR CHERRY POINT AND ONLY CROSS ONE FERRY ROUTE. WHILE SOME OF THE FREIGHT VESSELS STOP IN PORT ANGELES, EVERETT AND OTHER PORTS CROSSING ONLY SOME OF THE FERRY ROUTES ALONG THE WAY. I HAVE ELIMINATED TUGS AND BARGES FROM THE DANGER LIST AS A TUG HITTING A FERRYBOAT WOULD BE LIKE A VOLKSWAGON RUNNING INTO A TRUCK. A TUG WITH TOW WOULD BE GOING TOO SLOW TO DO SEVERE DAMAGE.

IN SUMMATION, BEFORE DECIDING TO ADD LIFE RAFTS TO THESE BOATS, YOU MUST FIRST CONSIDER IF THEY ARE NECESSARY AND DOES THE SAFETY RECORD OF THESE INLAND VESSELS WARRANT SUCH AN EXPENSE. THEN IN ORDER TO

MAKE THE ADDED LIFE RAFTS USEFUL YOU MUST ADD THE NECESSARY ADDITIONAL CREWMEN TO INSURE THE RAFTS CAN BE PROPERLY USED. IT IS MY OPINION THAT THIS EXERCISE IS A WASTE OF TIME AND EFFORT AND WILL NOT IMPROVE SAFETY ONE IOTA. TO PUT LIFE RAFTS ON THESE VESSELS WITH NO ONE TO PROPERLY LAUNCH THEM IS AKIN TO PLACING PARACHUTES ON A 747 AND TELLING THE PASSENGERS TO USE THEM IN CASE OF EMERGENCY. UNLESS THESE RAFTS ARE LAUNCHABLE THEY ARE AS USELESS AS PARACHUTES. FURTHER, TO REQUIRE THE WASHINGTON STATE FERRIES ALONE TO HAVE THESE RAFTS WITHOUT PUTTING THEM ON ALL OTHER INLAND VESSELS IS A TRAVESTY IN THE ARENA OF SAFETY.

JD:br
88-12:1801

SUMMARY OF VESSELS OPERATION————ENTIRE PSVTS AREA
1984-1987

VESSEL TYPE	TOTAL	AVERAGES MONTHLY	DAILY	% CHANGE (Annually)
**********CALENDAR YEAR 1984**********				
TANKER	1793	149.42	4.9	27.3
FREIGHTER	8890	740.83	24.29	78.4
TUG (w/o tow)	829	69.08	2.27	N/A
TUG (w/tow)	29233	2436.08	79.87	2.7
GOVERNMENT	3282	273.5	8.97	14.4
MISCELLANEOUS	6182	515.17	16.89	29.7
CG ESCORT	7	0.58	0.02	N/A
VTS SPECIAL	39	3.25	0.11	N/A
FERRY RUNS	149305	12442.08	407.94	0.3
YEAR 1984——	199560	16630	545.25	3.8
**********CALENDAR YEAR 1985**********				
TANKER	1810	150.83	4.96	0.9
FREIGHTER	10005	833.75	27.41	12.5
TUG (w/o tow)	831	69.25	2.28	0.2
TUG (w/tow)	29571	2464.25	81.02	1.2
GOVERNMENT	3139	261.58	8.6	-4.4
MISCELLANEOUS	7169	597.42	19.64	16
CG ESCORT	7	0.58	0.02	0
VTS SPECIAL	36	3.0	0.1	-7.7
FERRY RUNS	150724	12560.33	412.94	1
YEAR 1985——	203292	16941	556.96	1.9
**********CALENDAR YEAR 1986**********				
TANKER	1883	156.91	5.15	4
FREIGHTER	9938	828.16	27.22	-0.7
TUG (w/o tow)	1712	142.66	4.69	106
TUG (w/tow)	29886	2490.5	81.87	1.1
GOVERNMENT	3060	255.0	8.38	-2.5
MISCELLANEOUS	8896	741.33	24.37	24.1
CG ESCORT	13	1.083	0.035	85.7
VTS SPECIAL	55	4.58	0.150	52.80
FERRY RUNS	152496	12708	417.79	1.2
YEAR 1986——	207939	17328.2	569.69	2.3
**********CALENDAR YEAR 1987**********				
TANKER	1984	165.33	5.42	5.4
FREIGHTER	10614	884.5	29	6.8
TUG (w/o tow)	2755	229.58	7.53	60.9
TUG (w/tow)	26856	2238.08	73.38	-10.1
GOVERNMENT	3217	286.08	8.79	5.1
MISCELLANEOUS	10366	863.83	28.32	16.5
CG ESCORT	5	0.42	0.01	-61.5
VTS SPECIAL	43	3.58	0.12	-21.8
FERRY RUNS	157013	13084.42	429	3
YEAR 1987——	212853	17737.83	581.57	2.4

TESTIMONY BY ARMAND TIBERIO
BEFORE THE COMMITTEE ON MERCHANT MARINE & FISHERIES
MAY 31, 1988

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE:

Over the past 12 months there has been an increasing amount of attention paid to the way WSF crews its vessels and particularly the type of watch schedules employed within our system. At the core of this attention is a comprehensive report and study issued in May of 1987. This study was initiated by the management of WSF during labor negotiations with the Master, Mates and Pilots in 1983.

I can assure the members of this committee that the issue of work schedules and problems associated with irregular schedules has been on WSF's operating agenda for the past 7 years.

In order to fully understand what is at stake, I believe it is incumbent upon all interested parties to know why this issue is being discussed here today. Let me summarize the major and significant events.

1) On February 5, 1988, the committee on Merchant Marine and Fisheries submitted to the Commandant, U.S. Coast Guard, a request to inquire into a potential safety problem on board Washington State Ferries. Specifically, the request was to examine the problem of chronic crew fatigue resulting from inadequate rest between watches and the rotation of shifts.

In their request the Committee also states the following:

a) Officers....are routinely assigned work schedules that do not provide adequate time off for rest between watches, and.

b) Many officers and crew members work for ten consecutive days with as little as six hours off between shifts. In addition, crew members' shifts often rotate erratically requiring different starting and ending times.

2. In April, 1988, the U.S. Coast Guard issued its internal report in response to the Committees' request. For our purposes today, I believe the following findings are important.

a) Prior to 1982-1983 there was no work schedule dispute system-wide.

b) Only one WSF accident, as reported in U.S.C.G. investigative records cite fatigue as a contributing factor.

c) All WSF vessels are manned according to U.S.C.G. regulations and there exists no evidence that the manning requirements should be revised.

d) A question of adequacy was raised regarding the berthing facilities on board the WSF vessels.

e) The performance levels of WSF crew members would predictably suffer and likely be serious problems after an extended period of working unusual times and frequent changes called for by the schedule.

f) Of the 23 interviews that were conducted, many Captains felt they were not operating at or near optimum performance levels, this condition exists due to stress that is caused by congested traffic situations, long periods of monotony and boredom, seasonal fog and inclement weather and and frequent landings that exercise the required skills of the navigating team.

The Committee' inquiry request and the U.S.C.G.'s report have raised questions about the integrity of operating work schedules employed by WSF. To assist in clarifying our position, the following questions must be addressed:

1. What criteria or guidelines should be utilized in designing work shift schedules?

   Dr. Sparks provided answers to this question in her initial report and in a supplemental report issued April 14, 1988. (Appendix 1 & 2).

WSF, will, when not in conflict with existing labor contract provisions, statutory budget constraints, and the needs of our customers, endeavor to design work schedules that accommodate these guidelines.

2. What prior steps and/or actions have WSF taken to accommodate employees' wishes and desires regarding work schedules?

a) First, in designing work schedules to accommodate employee desires, we must be aware of other contractual conditions that must be satisfied. These include:

* Permanent employees must receive 80 hours of pay every two weeks, whether or not they work a full 80 hours.

* Any work over 80 hours is paid at double time.

* Overtime cannot be scheduled.

* Work periods are based on the 8 hour day but when service running times prevent reliefs at 8 hour shift intervals, then shifts of not less than 7 hours or more than 9 hours are permissible.

* Work periods must be either five consecutive shifts (days) with two consecutive days off, or ten shifts (days) with four consecutive days off.

* A employee must end their shift at the same terminal that the shift was started.

* Work shifts cannot be less than 6 hours form the end of one shift to the beginning of the next shift.

* Deck work schedules must accommodate the need for vessel fueling, vessel sewage pumping, and engine room crew schedules.

IN SUMMARY:

* ALL VESSEL CREW WORK SCHEDULES MUST BE DESIGNED TO ACCOMMODATE THESE REQUIREMENTS.

b) As was referenced in Dr. sparks report (P.1) work shifts for deck crews were changed in 1982 to accommodate decreasing ridership demands and service budget constraints. In summary, the existing graveyard shifts that worked between the Seattle/Bremerton and Seattle/Winslow routes were eliminated, thereby causing an acceleration in rotating shifts and different starting times. This pattern was, however, restricted to the Bremerton and Fauntleroy/Vashon routes.

Prior to implementing the work schedules in 1982, there were alternative work schedules formulated in conjunction with the Master, Mates and Pilots. Because only 50% of the Seattle/Bremerton deck employees were unfavorable to the proposed changes the schedules, which included the rotating shifts, continued.

c) In 1983, and continuing into 1984, a special MM&P and WSF Labor/Management committee was established to review and develop alternate work schedules. At this time the only work schedules identified as causing employee discomfort was the Seattle/Bremerton work schedules. While this joint committee met on numerous occasions and developed alternate work schedules, improvements, in the minds of WSF employees, were not occurring. This is principally due to the task of developing working schedules within the parameters of: labor contract regulations, budget constraints, and customer needs for reliable service schedules.

d) While no agreement had been reached with the MM&P and our ferry Captains, WSF was committed to addressing the issue of shift rotation and its possible impacts on employee performance. Toward this end WSF proposed that an independent study be conducted to assess our work schedules and to determine what, if any, negative impacts will be caused by our schedules.

e) The findings, conclusions and recommendations of that study are addressed in Dr. Patricia Spark's shift work report issued in May, 1987.

f) In October, 1987, WSF, working with selected Captains assigned to the Seattle/Bremerton route, developed and implemented changes to their work schedules. We believe the changed work schedules reduces and/or eliminates the major concerns/issues that have been raised

since 1982. Appendix 2 provides a summary and comparison of those changes.

g) WSF is committed to developing and implementing, wherever possible work schedules that address appropriate health and safety concerns of our employees. To achieve this objective WSF has agreed to establish a permanent committee of MM&P representatives and WSF management personnel whose purpose will be to examine existing work schedules and recommend improvements to WSF while taking into consideration the findings and recommendations of Dr. Spark's study and report.

3. What steps and/or actions should be initiated if work scheduling problems persist into the future?

Washington State Ferries firmly believes that additional governmental regulations in this matter is not necessary or warranted. Referring to Commander Yost's letter of May 10, 1988, Washington State Ferries is in compliance with Title 46, U.S. Code, and is in compliance with all manning requirements as required by CO MSO Puget Sound.

Also, there is no evidence contained within Dr. Sparks' May, 1987 report nor the Synopsis of Inquiry on Work Hours on Washington State Ferry Vessels, which leads one to believe or reason that a bonafide need exists to amend, modify, or revise Title 46.

The steps and actions that should be taken are exactly the ones Washington State Ferries has initiated and will continue to initiate. Only by continuous monitoring and assessing our work schedules can the objectives and guidelines spelled out by Dr. Sparks be realized. To require 10 hours off between shifts in lieu of 6 hours will do nothing about eliminating a rotating shift problem.

As with most employer/employee related problems and issues we believe the parties at interest are the ones to resolve their differences. By recognizing Section 802 of the labor contract between Washington State ferries and MM&P we believe this objective will be accomplished (See Appendix 5)

In conclusion, Washington State Ferries believes the guidance provided to it by the Dr. Sparks report is sufficient to guide its actions and decisions into the future. While the research studies, reviews, interviews and questionnaires conducted thus far do suggest some scheduling problems exist, we firmly believe that the preponderance of our vessel crews are satisfied with their current schedules. As in the past we are committed to monitoring all serious scheduling problems and to making appropriate adjustments whenever possible. At this time modification to existing statutory regulations is neither necessary nor appropriate.

###

Capt. Gary Fredback
Washington State Ferries
Pier 52
Seattle, Wa. 98104

Members, Subcommittee on
Coast Guard and Navigation
U.S. Federal Bldg. 4th Floor
915 2nd Ave.
Seattle, Wa. 98104

Subject: Ferry Vessel Safety on Puget Sound

Ladies and Gentlemen,

The data on fatigue and circadian desynchronosis (performance degradation) has been recognized for a number of years. Studies exist which provide extensive evidence that fatigue is greatly increased in association with:

1. Sleep loss or deprivation and alterations of habitual sleep/wake cycles.

2. Circadian desynchronization associated with irregularity of work/rest cycles.

3. Long duty hours.

4. Other human factors such as:

   a. Long periods of low activity and lowered sensory input.

   b. Letdown/relaxation/boredom.

   c. Less than optimal nutrition.

   d. Use of depressants or stimulants or other non-nutritive substance used to counteract fatigue and sleep difficulty.

While many of these factors are interrelated, the concept of pilot-capacity/demand-on-the-pilot provides a model for estimation of the margin of safety. Pilot capacity is diminished by the factors enumerated above while demand may be constant or may increase, thus reducing the margin of safety.

The parallels between passenger vessel (ferry boat) pilots and airline pilots provide us with an opportunity to observe how the representative companies have dealt with the most important factor of all, the human factor. People do not perform like machines.

The airlines have, over the years, been under the watchful eye of the Federal Aviation Adminstration (F.A.A.) to ensure that aircraft conduct business in a vigilant and discerning manner for the absolute safety for all. Recommendations, guide lines and new regulations are periodically drafted by the U.S. Government to assure that the latest in safety related findings be implemented by the F.A.A. to regulate the ever increasing overcrowded skies. As an example, on March 23, 24, 1983, the subject of biological clocks and shift work scheduling was studied at the Hearings before the Subcommittee on Investigations and Oversight of the Committee on Science and Technology, House of Representatives Ninety-Eighth Congress, chaired by Sen. Albert Gore.

Washington State Ferries (W.S.F.) operate under jurisdictions set forth by the United States Coast Guard (U.S.C.G.) who consider and preside over all facets of safety for the well being of those who sail on W.S.F. under the C.F.R.s (Code of Federal Regulations) Title 46.

With regard to the recent survey and subsequent study of the Masters Mates and Pilots of W.S.F. on health indices relevant to shift work, conducted by Patricia J. Sparks, M.D., M.P.H., and the fact that over 200,000 vessels of increased tonnage and higher speeds enter Puget Sound annually (excluding pleasure craft) I feel the U.S.C.G. must enact new regulations in the C.F.R.s Title 46 to amend and better define working hours for masters and mates of W.S.F. to avoid the hazards associated with circadian desynchronosis and mental fatigue. These amendments should closely follow the recommendations set forth by the aforementioned study.

With the amount of information available from studies on the subject of sleep deprivation and it's resultant affects, it is clear the liability is far too great for ferry system management to ignore any longer.

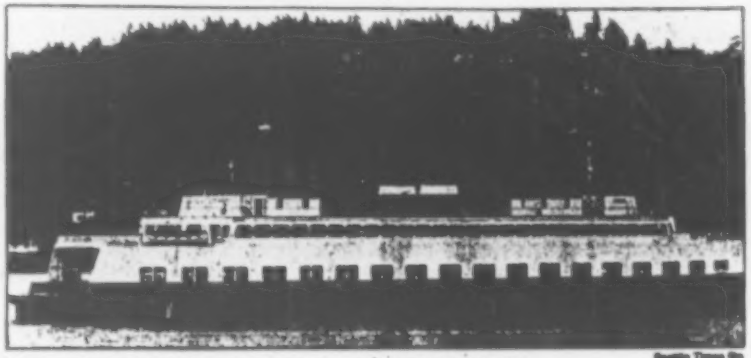
Thank you,

Capt. Gary Fredback

Capt. Gary Fredback

Rotating shifts certain to produce groggy ferry crewmen

Capt. Gary Fredbeck
Special to The Times



Seattle Times file

A ferry leaving Southworth, Vashon Island, for Fauntleroy in West Seattle.

SHOCKING! That's my reaction to the masters and mates of the Washington State Ferries who are sleeping on the job. How dare they! I mean, those guys make very good wages, don't they? They can stay awake and/or afford whatever drug (legal or otherwise) it takes to become superhuman.

The fact that airline pilots fall asleep doesn't give ferry workers an excuse. Although airline pilots' schedules aren't easy, I know the Federal Aviation Administration would not allow them to work the hours ferry employees do. The human factor is considered a safety factor. People just don't perform like machinery.

Masters and mates say the rotating shifts are too exhausting, and if you ever work similar hours, you'll learn about mental and physical fatigue and circadian rhythms (biological clocks).

I've worked a few of those schedules. One of them goes like this: Start your week on a Saturday at 8:25 a.m., departing from Fauntleroy; however, your time begins at 8:30 on Vashon Island. This is known as "deadheading" to your job.

Weekend traffic is always heavy, so you put in a long day that ends at 4:30 p.m. unless you deadhead, in which case quitting time is 5:30 p.m. at Fauntleroy.

If you live a half-hour away, you're home by 6 p.m. Dinner and a little conversation with the family, and it's 7 p.m. Kiss the wife and kids goodnight and go to bed. At 7 p.m.? That's right.

Let's hope the neighbor doesn't decide to mow his lawn this hot summer evening, or the dogs next door aren't restless, or the kids across the street don't throw another one of their endless parties. After all, it's Saturday night. At 11 p.m., whether you've slept or not, the alarm goes off and it's time to get ready to go back to work.

After a shower, grabbing a thermos of coffee and a few snacks, you're out the door before midnight to catch the 12:30 a.m. (Sunday) ferry to start work at 12:30 a.m.

In this line of work, you can't afford to be even a few minutes late or your office will have sailed off without you. The night is a long grind and ends at 8:30 a.m. Catch the 9:30 ferry back to Fauntleroy, arriving at 9:40 a.m. and home a half-hour later.

Still full of coffee, you're up for awhile and try to visit with the family. Everyone finds you in a "quiet mood," so they leave you alone.

In bed by noon, hoping for sleep. However, instead of mowing the lawn last night, the neighbor decides to do it today, starting at 1 p.m. After mowing what has to be half the rocks in Seattle, he's done around 2:30 p.m.

Also, there's a baseball game going on in the street that you couldn't hear over the lawnmower. The kids are having a great time, but sleeping isn't sound. It's 7 p.m. and you are awakened for dinner with the family. Energy for conversation is low. You spend the evening trying to enjoy the family and dozing in front of the tube. At 11 p.m. it's time again to get ready for work.

Another graveyard shift, but this time, being Monday morning, you deal with hurried commuters. Those aboard are angry if the ferry is late, and those ashore are upset if you're on time.

Back home again. No problem getting to sleep this morning. A nuclear war wouldn't wake you. If you wake at all, you feel drugged. At 7 p.m. it's dinner once again and an evening with the family; 11 p.m., you're wide awake and ready for work, since you've slept most of the day. Even your circadian rhythm has come around to working nights.

Well, guess what? You're supposed to be in bed, as you are to be up at 4 a.m. to catch the 5:30 boat to be at work at 5:30! Still with me? We're talking Tuesday morning here.

Off work by 2 p.m. or if again deadheading, 3:15 p.m. By now your circadian clock is out the window and normal bodily functions begin to malfunction. Back to bed early evening, but having trouble sleeping because now you're wired tired. About the time you feel you've fallen sleep, the alarm says it's 4 a.m. and you better start rolling.

You feel listless. There's a buzz in your head. Time for more coffee, which now only makes the buzz louder. You know it's going to be a long day, but hope for an easy one. Quietly closing the back door and heading for your car, you find the fog is so thick you could eat it with a fork. Your heart, which now beats irregularly, sinks. You pray it's just local.

Arriving at the dock, you find that it's much worse. In the pilothouse and at your station behind the radar, your whole body feels awful. Groping to get your brains clicking, you think, "Sure would be nice to be grounded like the airlines."

The ferries parallel the airlines in many ways, except the commodity here is on a much larger scale. The bigger ferries will carry up to 2,500 people, more than the Titanic did. Feeling the way I do, the stress of this responsibility is mind-boggling.

Is this how one should feel in a responsible position? What happened to feeling sharp, confident, self-assured, or even dauntless? Ferries are equipped with radar to serve as a mechanical aid when navigating in the fog. What's needed now is a human radar to help navigate us when our circadian radar is all fogged up.

This situation is extremely dangerous, and I'm sure that all the personnel in the dock department join me in saluting Rep. Mike Lowry for his efforts to bring this risky condition in focus.

I'm relieved to know the word is out about these ominous, inhumane schedules and what it is doing to these people and their families.

Management now has jumped on the bandwagon and says, "Hey, we're working on it." I wonder how much psychological and physical damage has been done since these schedules were implemented over five years ago? How many families have suffered or split up? How many lives were endangered because management interests lay elsewhere than in protecting lives?

If an accident like the sinking of the Herald of Free Enterprise should happen, who do you suppose will hang? Not management.

It's time the Department of Transportation and the Legislature wake up and start considering the human side of these ferries and begin appropriating funds to subsidize the marine highway system as they do the rest of our state highways. I encourage any legislator who cares about the safety of our passengers and the well-being of those responsible for their lives to come out and observe these schedules.

Or, easier and less stressful, work these hours in the comfort of your own office and see what happens to your productivity. You may just be grounded by the internal fog.

■ Gary Fredbeck, a captain with the Washington State Ferries, lives in Seattle.

THE EFFECTS OF SHIFT-WORK ON HEALTH, JOB PERFORMANCE, JOB SATISFACTION, AND WORKER PRODUCTIVITY:

PART ONE
A SUMMARY OF FINDINGS PUBLISHED IN MEDICAL JOURNALS

PART TWO
RESULTS OF A SURVEY OF WASHINGTON STATE FERRY CAPTAINS AND FIRST MATES WORKING ON THE SEATTLE-BREMMERTON RUN BETWEEN 11/10/84 AND 11/23/84

RALPH A. PASCUALY, M.D.
MEDICAL DIRECTOR
PACIFIC NORTHWEST SLEEP/WAKE CENTER
11/26/84

Over 20% of the American workforce is assigned to evening or night shifts or rotating shift work. In some industries the proportion of the workforce on shift schedules may go as high as 50%. As worker dissatisfaction has grown over shift work assignments, medical researchers have performed studies to investigate the effects that these schedules have produced on the health, well-being and efficiency of shift workers. Research has also been performed to determine what types of shift work schedules are most effective in minimizing health risks and maximizing well-being and productivity in shift workers.

Biological rhythms are found in almost every living thing and at every level of organization in the world. They are in no way connected, related or derived from the so called "Bio-rhythms" that are frequently found in daily newspapers and astrology books.

Shift workers develop problems and complaints as a result of their patterns of sleep and wakefulness becoming detached or disassociated from their internal biological rhythms. A biological rhythm is an element of life that when observed over a long enough time will begin to repeat itself at regular intervals. Some rhythms such as the rhythm of body temperature repeat themselves every 24 hours. Other rhythms such as a woman's menstrual cycle, repeat approximately every 28 days. Literally hundreds if not thousands of rhythms are constantly at work within the human body at all times regulating the various biological functions. The rhythms are controlled by a host of "clocks" in the brain that tell different chemicals when they are needed

and when they are not. These needs are regulated by a person's biological needs such as protein utilization, oxygen need etc., and by their daily activities such as sleeping, eating, and exercising. If a person's schedule of daily activities changes due to shift work, the biological rhythms begin to change to correspond to the new activity schedule. When the schedule changes more rapidly than the biological functions are able to change to accommodate these changes the result is a person who will have sleep problems gastrointestinal problems, complaints of tiredness, fatigue, restlessness, irritability, nervousness, memory problems, depression and other medical and psychiatric complaints.

Below are listed as series of findings have been reported in medical research journals and represent the most up to date knowledge on shift work and its influence on biological rhythms, health, job satisfaction, and job performance.

1. Shift workers have poorer quality sleep than day workers.

When the time of sleeping is shifted from night to day the quantity and quality of sleep is often disrupted. Research performed by Menzel and others indicates significant differences in the sleep of workers, depending on the shift that they are working. Figure 1. illustrates these differences. As can he seen, workers on night shifts, whether working on a temporary shift or permanent shift, have a higher incidence of sleep problems than non-night workers.

2. Shift workers are not able to sleep as long as day workers. (5 hrs. average vs. 7.5 hrs. average)

The inability to sleep for a full sleep period is usually related to a disturbance in the body's circadian rhythms. The rhythm of body temperature is important in regulating the ability to sleep. The body temperature has a daily rhythm that is highest in mid afternoon and lowest in the middle of the night. (For a person who is sleeping nights and working days) Although the body temperature varies by only a small amount (1.5 degrees C) these small changes can have major effects of the brain and the timing of sleep. If a person attempts to sleep when the body temperature is very high it will be very difficult to fall asleep and it will be very likely that if a person does fall asleep that they will not sleep very long before waking up. The converse is also true: if a person attempts to stay awake when the body temperature is at a low level it will be very difficult and if the person does fall asleep it is very likely that if left undisturbed will sleep until the body temperature begins to rise, which may be as long as 10 hours. During shift work rotations the body is often asked to sleep at times when the circadian rhythms are suggesting that the body be awake and to be awake when the natural inclination is to be asleep. After a change in shift the body begins to attempt to accommodate to this change. Unfortunately, the accommodation is never instantaneous; in fact, there are dozens of circadian rhythms in the body and when a shift change occurs they all begin to change to accommodate the new schedule, but the change occurs at different rates for different rhythms. What then occurs is that the rhythms become desynchronized from one another as they shift toward the new schedule. The result is below par mental and physical functioning

that manifests itself as fatigue, sleep disturbance, nervousness, depression, worry, forgetfulness, gastrointestinal problems, and lack of energy.

3. Of workers on night shift, 60% report that they feel they have a sleep disturbance. (Study by Rutenfranz and co-workers)

4. Shift workers have a higher incidence of peptic ulcer disease than day workers. Like other organs, the gastrointestinal organs also have circadian rhythms. The secretion of chemicals for the digestion of food does not occur simply as a result of a response to food in the digestive system. These secretions are elicited by a complex set of factors, one of which is the sleep/wake schedule. When a shift schedule changes, and a person begins to eat on a different schedule than before the secretions will continue to be released on the previous schedule of eating for quite some time before they can accommodate to the new schedule. When the secretions are present at times other than mealtimes the result can be an irritation to the gastrointestinal tract. If this process is repeated for prolonged periods of time the acidic secretions may begin to digest away parts of the stomach and small intestines. The result is gastritis, heartburn, indigestion, stomach pains, and finally, an ulcer. Ulcers are twice as likely to occur in shift workers than in non-shift workers.(Studies by Costa, Rutenfranz, Knauth, and others)

5. Shift workers have a higher incidence of all general gastrointestinal problems than day workers. See figure 3. (Rutenfranz, Knauth, Costa and Leonard)

6. Diabetes and epilepsy are made worse by shift work schedules. Since the secretion of insulin is in part determined by mealtime schedules it follows that diseases that result from disordered regulation of insulin secretion would he made worse by shift schedules that disrupt regular mealtimes. This is in fact the case. Most diabetics find that rotating shift work is nearly impossible for them to tolerate and people with borderline diabetes may in fact become much worse during shift work. THe same is true for other disorders such as epilepsy. A person with epilepsy will experience an increase in the frequency of epileptic seizures when the usual sleep/wake rhythm is disrupted.

7. Older workers are less able to tolerate rotating shift schedules than younger workers. As we grow older our biological system becomes less and less ahle to adapt to changes in any routine. When routines are changed too frequently for the body to adapt, this loss of resiliency manifests itself as a condition known as "circadian desynchrony". Circadian desynchrony refers to a condition that occurs when the body's master clock loses it's ability to control some of the other biological rhythms. The rhythms thereby become "dissociated" from each other and run on a schedule that is independent of the master clock. The result is the same as that seen when younger workers are begun on a new shift schedule except that the effects persist for a longer period of time; frequently the change can become permanent and the body is forever running out of synch with itself. As in younger people, the effect is sleep disturbance, loss of energy, tiredness, fatigue, memory problems, difficulty making decisions, depression, and other similar

problems. (Studies by Akerstedt, Bensimon, and others)

8. In most people, 1 day of adjustment is required for the human body to adapt to each hour that a sleep/wake schedule is altered. E.g., the body's hormones, and brain chemicals that control our sleep and wakefulness will take at least 8 days to re-adjust themselves to a new schedule that requires sleeping at a time that is 8 hours later than the previous schedule. (Czeisler, Moore-Ede)

9. Shift workers report more sex-related difficulties and disturbed relationships than day workers. (LaDou, Rutenfranz)

10. On-the -job accidents occur most frequently at the beginning of a new shift schedule and accidents that occur during the night shift are more serious than those occurring during evening and day shifts.(Andlauer)

11. The incidence of work errors is highest between 3am and 5am.

12. Certain medications may facilitate the adaptation to a new shift schedule, but must be taken in strict accordance with a physician's orders. (Siedel)

13. Rotating shift-work schedules that follow biological principles can improve worker job satisfaction, subjective health estimates, personnel turnover rates, and worker productivity. In an article published in the most prestigious scientific journal in the world (Science) it was demonstrated that the application of circadian principles can substantially impact the

nature of an industrial organization. These findings were obtained in a controlled field study environment and are substantiated by a follow-up study conducted 1 year after the initial study. (Czeisler)

FIGURES:

PART ONE

A SUMMARY OF FINDINGS PUBLISHED IN MEDICAL JOURNALS

1. These values represent the findings of Rutenfranz and others and demonstrate the differences in reported sleep disturbance in workers on different shifts.

2. Henzel and co-workers reported these findings in a study of German shiftworkers. The results indicate that workers on night shift are able to sleep an average of 5.5 hours during their sleep period as opposed to 7.5 hours and 8.5 hours averaged by day and evening workers respectively.

3. Gastrointestinal complaints are common in night shift workers as is indicated in figure 3. Remarkable is that a higher incidence of problems exists even in former night workers who are now on day shift.

PART TWO:

RESULTS OF A SURVEY OF WASHINGTON STATE FERRY CAPTIANS AND FIRST MATES WORKING ON THE SEATTLE-BREMMERTON RUN BETWEEN 11/10/84 AND 11/23/84

FIGURES

4. Of Captains and First Mates surveyed on the Seattle-Bremmerton run in the Washington State Ferry system the two major complaints were sleep problems and decreased pep.

5. Figure 5 demonstrates that due to irregular work and sleep schedules the average number of hours slept varies considerably from night to night. The sleep of day workers generally will vary only by 30 to 45 minutes from night to night.

6. When the actual variability from the sleep of day shift workers is compared to the ferry workers a considerable difference is apparrent as is indicated by figure 6. These workers rarely slept a normal amount during the entire two week survey period but instead tended to sleep for much shorter periods during the work week while sleeping for extended periods during days off apparently attempting to make up the accumulated sleep deficit.

7. The general mental health of the ferry workers surveyed indicates considerable difficulties in coping with the shift work schedules. The majority of those surveyed show the classical symptoms of circadian desynchrony

and sleep disturbance as indicated by this graph.

8. The incidence of gastrointestinal disturbances and headaches is considerably beyond the normal range in this group of workers.

9. The number of workers feeling excessively fatigued and the number seeking medical attention for fatigue is clearly outside of the normal range.

10. These patients report excellent general health with the exception of two reporting either past or present history of ulcer disease, two reporting either past or present hypertension and one reporting arteriosclerosis. The physical complaints being reported cannot be explained on the basis of general poor health or other disorders.

11. All those responding felt that their sleep was abnormal. 91% felt that they were excessively sleepy during the daytime, 73% said that they found themselves fighting sleep while carrying out routine tasks, and 91% felt that the quality of their work was impaired by their sleepiness. None of those surveyed felt that they had had a sleep problem in the past that was worse than their current problem.

12. Of the 24 auto accidents reported in the lifetime of these workers 38% of those accidents reportedly occurred due to falling asleep at the wheel. These workers also reported that in 44 additional instances they had experienced a near-miss auto accident due to sleepiness. Also reported were 7 instances of on the job accidents that were attributable to falling

asleep while working.

CONCLUSIONS:

The presently used shift schedules are not designed to allow a reasonable adaptation of the body's biological rhythms to the work schedules. The overwhelming majority of workers report the classical signs and symptoms of chronic desynchronization of sleep/wake rhythms including great variability of sleep time, insomnia, chronic fatigue, chronic complaints of gastrointestinal disturbance and others. An alarming 58% of workers reported work-related accidents attributable to fatigue or sleepiness. Equally disturbing is the report of 44 near-miss automobile accidents as a result of sleepiness while driving. These data cannot be explained by chance alone and provide overwhelming evidence that these shift schedules are a primary factor in determining the level of sleep disturbance, physical distress and emotional complaints of stress and abnormally high rate of work and automobile accidents related to fatigue or sleepiness.

PROVIDENCE
MEDICAL CENTER

SLEEP DISORDERS CENTER

July 26, 1988

Earl Hutto, Chairman
Subcommittee on Coast Guard Navigation
U.S. House of Representatives
Committee on Merchant Marine and Fisheries
Room 1334
Longworth House Office Building
Washington, D.C. 20515-6230

Dear Mr. Hutto:

Enclosed are my replies to questions you posed relevant to the Washington State Ferry vessel employees. My answers are based on having treated thirty workers for shift-work related disorders, as well as an evaluation I have performed on the effect of the shifts on ferry workers' health complaints.

From a medical standpoint, six hours between shifts is an inadequate amount of time for rest and recovery. There are several reasons for this. First of all, within a six-hour period off duty, it simply is not possible to drive home, wind down, and achieve a restorative sleep period in time to wake up and return to work. If the six hours off represents a period where the individual would normally have been awake on the preceding several days, it might actually be impossible to sleep at all.

It is not possible to give a specific recommendation on the optimal number of days and weeks an individual should remain on a given schedule prior to rotating to a new schedule. This will depend greatly on the overall structure of the scheduled times off, shifts worked, and direction of the rotation of the schedule.

Based on my review of the shifts of the Washington State Ferries, I feel that significant improvements could be made in the current scheduling system to prevent chronic crew fatigue. However, the schedules would have to differ, depending on the runs, number of crew, etc. The only simple recommendation that could apply as a general principle is that the shifts should rotate in the direction of delaying the bedtime. For example, to rotate from day shift to evening shift to night shift. More specific recommendations would have to made based on the actual staffing and service hours involved.

SISTERS OF PROVIDENCE
PROVIDENCE MEDICAL CENTER
500 17th, C-14008, SEATTLE, WASHINGTON 98124 (206) 326-5555

Mr. Earl Hutto
July 26, 1988
Page Two

I am not currently working with the Washington State Ferry system to resolve outstanding scheduling problems. Although my practice is limited to sleep disorders medicine and circadian rhythm schedules, it has not been possible to assist the system. After my initial study several years ago, I testified that some type of arbitration hearings were needed between the union and the system, but no further action was taken.

It is clear that the public safety, worker morale, the overall cost efficiency of managing these employees is very adversely affected by poor shift scheduling.

Please do not hesitate to contact me if I can be of further service.

Sincerely,

Ralph Pascualy, M.D., A.C.P.
Accredited Clinical Polysomnographer

Medical Director
Sleep/Wake Center

574/31B19

STATEMENT BEFORE
SUBCOMMITTEE ON COAST GUARD AND NAVIGATION
U.S. HOUSE OF REPRESENTATIVES
SEATTLE, WASHINGTON MAY 31, 1988
BY

EDWARD WENK, JR.
EMERITUS PROFESSOR OF ENGINEERING AND PUBLIC AFFAIRS
UNIVERSITY OF WASHINGTON

This testimony was prepared at the invitation of the chairman to address H.R. 4518 that amends title 46 of the United States Code to enhance safety of ferries operating on Puget Sound. In submitting this statement, I represent only myself--as a professional engineer with over 40 years of practice in the field of marine technology and science policy, most recently with specialization in risk assessment and safety.

H.R. 4518 primarily calls for life rafts to accomodate all persons on board the ferries. Without reservation, I endorse both the objectives and the specifics. What follows explains why.

As background, may I recall a major study on Improving Maritime Traffic Safety on Puget Sound Waterways that was released in October, 1982; I served as study director. The report contained ten recommendations to reduce risk, one dealing explicitly with provision of life rafts on ferries. After review by U.S. and Canadian Coast Guard authorities, the Washington State ferry system, and a number of experienced mariners who use Puget Sound, the final draft was publicly released in December, 1982.

Almost immediately, the report was attacked by federal and state authorities responsible for ferry safety, contending that all was well and that the system needed no improvements. Their strenuous attempt to discredit the report did not succeed. However, for almost two years the recommendations were totally ignored, despite my initiatives and those of 52 ferry captains who concurred with the findings, including requests to Congress and the State Legislature for hearings. All agencies revealed attitudes of indifference, on top of which safety authorities acted with complacence and a tone of infallibility. Attention was given to the study only after a series of mishaps in 1984, including irresponsible piloting of the ferry ELWHA that led to hull rupture.

You can thus recognize how pleased I am to see this initiative by Congressman Lowry.

The 1982 report which is highly relevant to this hearing examined the question of how to reduce risks to human life, to

property, and to the environment. The issue of safety did not arise, incidentally, because of a high rate of casualties. Rather, it was an awareness that Puget Sound is unique with its conflicting uses and traffic mix, its navigational constraints of rocky coasts, severe conditions of tide, current and storm, its volume of ferry service, its high economic value in hosting a valuable fishery and attractive recreational opportunities, and its environmental sensitivity.

To these circumstances should be added the absence of any comprehensive study of maritime safety in the Sound, the release of concerns by the National Transportation Safety Board because of some close shaves involving ferries, and the analytical reality that under conditions of rare accidents having potentially catastrophic effects, prior experience and casualty data are useless. In short, no one knew how safe was safe. Thus, the study.

In order to evaluate safety of the entire maritime system, it was necessary to consider all classes of ship traffic, all causes of serious accidents, and all possible measures to either prevent accidents or mitigate consequences. The study determined that the worst case of risk on Puget Sound lay with ferry passengers.

Ten risk abatement measures were recommended. One set was to reduce accidents themselves:

- Impose more rigorous professional qualifications of mariners,
- Strengthen on-water policing and enforcement, including stifffer penalties for violations,
- Impose selective speed limits,
- Limit ferry speed in fog,
- Improve weather reporting,
- Impose more effective vessel traffic control,
- Standardize bridge-to-bridge communications, and
- Institute a voluntary reporting system for close shaves, recognizing that such pre-accident data reveal dangerous conditions.

Should accident prevention fail, two additional recommendations were made, of critical importance to safety of ferry passengers:

- Install liferafts on all ferries sufficient to accomodate

all crew and passengers, and

- Strengthen contingency planning for rescue in event of casualty.

The risks associated with ferries were underscored because ferries travel in all kinds of weather; cross traffic lanes; make an enormous number of transits. They thus have the greatest statistical risk of casualty. Moreover, human lives were at stake, perhaps 2500 in a fully loaded ferry. In a worst case of severe damage and fire from ruptured fuel tanks in vehicles or in the vessel itself, passengers would have to evacuate. And while life jackets would keep people afloat in the water, in a short time hypothermia would lead to death especially for children, the aged and infirm. Thus, the need for liferafts.

The study was based, incidentally, on a detailed analysis of U.S. and Canadian Coast Guard casualty data, violation reports, interviews with users of the Sound, and on a "fault tree" analysis that utilized artificial scenarios of some 25 causes of accident and their chain of consequences.

Safety authorities have disputed the report proposals, including that for liferafts. They have contended that (1)because of so few accidents in the past, none should be expected in the future; (2)it is safer to remain on a disabled vessel than take to the water; (3)rescue could always be effected swiftly because the ferries are never more than a few miles from land; and (4)enhancing safety is too costly.

I disagree on all counts. First, a fantasy of zero risk has been disproved in other technologies, by the Three Mile Island and Chernobyl accidents, CHALLENGER, Aloha's 737 that literally blew its top It is a myth in dealing with maritime safety. Internationally, the number of ship collisions, fatalities, and financial losses have not been significantly reduced by high technology; indeed, the collision rate per vessel trip, as a collision exposure index, has increased. Around Puget Sound, we are familiar with ferry docks knocked out, bridges destroyed, oil spilled. Because human error is the cause of 75% of all accidents, high-tech aids are not infallible; indeed, we now experience the "radar-assisted collision."

For authorities to expect passengers to remain on a vessel seriously damaged and afire is neither responsible nor realistic.. The argument that swift rescue is assured because ferries are never more than a few miles from land is bogus and has never been put to a test. On the San Juan Island run, for example, mishaps at night and in bad weather would be seriously complicated by the limited number of rescue vessels that could be mobilized to reach the scene within hours. In the 4-knot

currents in Rosario Strait, people in the water would be quickly separated and swept away. Additionally, there are problems of mismatch in radio communication between maritime and land stations, already observed in a ferry grounding.

As part of the 1982 study, I examined the contingency rescue plans of the Coast Guard and found serious gaps and discrepancies. Ferry masters had never been consulted, and even now have no copies of a rescue plan. Among other deficiencies, there were serious questions as to how a large number of burn or hypothermia cases could be transported and which medical facilities were prepared for such emergencies.

Although I realize that this issue of contingency planning is beyond the scope of the draft legislation, I earnestly suggest that your inquiry be broadened.

For one thing, ferry operations cannot be isolated from other traffic; thus, the question of ferry safety cannot be addressed without looking at the safety of the entire navigation system. The hazard of ferry collision always involves other vessels, and collision avoidance attempted by a ferry master could well be defeated by other accident promoting conditions, ignorance, error or blunder by operators of another vessel.

Indeed, I respectfully urge that safety authorities should be queried on their response to all ten of the recommendations, among other things to raise the level of consciousness of these agencies as to opportunities to reduce risk at low cost. The crux of the matter is that risk is defined as a product of two factors: probabilities of an accident and severity of consequences. The low frequency of accidents offers absolutely no assurance of low risk because a rare accident involving a ferry could be a calamity. It has been, elsewhere.

The two proposals for strengthened mariner qualifications, and tougher enforcement and penalties are especially salient. Because the principle locale for accident avoidance lies in the wheelhouse, and because the primary source of accidents has been confirmed as human error, I should like to renew my emphasis on these steps for accident prevention.

Even granted the high professionalism and skill of ferry masters, luck still plays a significant part in distinguishing a close shave from a casualty, an incident from an accident, a fender bender from a catastrophe. We do not need another TITANIC to understand the tragedy associated with insufficient liferafts. We know how to reduce risks. What we need is further determination to do so, including a commitment by safety and operating authorities to put passenger safety first.

LITERATURE REVIEW AND SURVEY OF MASTERS, MATES, AND PILOTS OF THE WASHINGTON STATE FERRIES ON HEALTH INDICES RELEVANT TO SHIFT WORK

Patricia J. Sparks, M.D., M.P.H.
Consultant in Occupational Medicine

Background

In 1982, work shifts for the deck crews aboard the Washington State Ferries were changed to accommodate ridership demands and budget constraints. Rapidly rotating shifts with several different starting times every week became more common. On the Bremerton-Seattle runs, the work shifts changed 3 times in an 8 day period with starting times as early as 5 a.m. and finish times as late as 2 a.m. At first, it was assumed that these more variable shift schedules would be a temporary measure, but most of the scheduling changes have persisted to the present time. A copy of the shift schedules for 1986 appears in Appendix A.

The Washington State Ferries shift schedules vary considerably from the traditional day, evening, and night shifts of manufacturing and other service industries (7 a.m. - 3 p.m., 3 p.m. - 11 p.m., and 11 p.m. - 7 a.m.) because of the scheduling demands of the ridership and other constraints. Shift schedules are greatly influenced by the fact that the ferry system is a public system operated by the State of Washington and subject to changing political and economic pressures.

In February of 1984, forty-two ferry crew members expressed safety concerns, related to the variable work hours, to the State Transportation Commission. A provision was included in the 1983-1985 labor contract between the International Organization of Masters, Mates, and Pilots and the Washington State Ferries which required that a system-wide review of employee work schedules be conducted by an independent consultant for the purpose of determining the impact of the current schedules on productivity, efficiency, and health and safety.

The International Organization of Masters, Mates, and Pilots (IOM,M&P) contracted with Dr. Ralph Pasqualy, a specialist in sleep disorders at Providence Medical Center, to do a survey of the sleep patterns of the Bremerton run masters, mates, and pilots. This survey seemed to corroborate the above concerns (Appendix B). It was decided to do a more system-wide evaluation of these concerns in 1986 and the author was contacted by the Washington State Ferries and several members of the IOM,M&P to conduct the following study.

Materials and Methods

The current literature on the effects of shift work on health, social and psychological functioning, and performance is reviewed in Part I of this report. An extensive bibliography of articles related to the above appears in Appendix C.

Masters, mates, and pilots on the Seattle-Bremerton, Kingston-Seattle, and Edmonds-Kingston run were interviewed by the author regarding aspects of shift work that they like and dislike and how shift work affects their health, social and family life, and performance. Job demands and performance requirements were discussed. Based on these interviews, a questionnaire was chosen for a more systematic survey as described below.

Open ended questions were included at the end of the survey form to obtain comments from licensed crew members who were not interviewed personally. Comments from the interviews and questionnaire appear in Part III of this report.

A survey questionnaire developed by Smith, Colligan, and Tasto (1979) of the National Institute of Occupational Safety and Health (NIOSH) was obtained with permission of Colligan and modified to include job and incident/performance information specific to masters, mates, and pilots of the WSF. The questionnaire of Smith and Colligan has been administered to over 2000 shift workers nationwide and has been pre-tested to include only those items that are of value in discriminating shift work problems. The survey questionnaire contains over 250 questions on background, personal habits, lifestyle, job, health, psychological status, sleep and eating patterns, and shift schedule. A copy of the questionnaire and cover letter appears in Appendix D.

The questionnaire was mailed to all members of the International Organization of Masters, Mates and Pilots employed as such by the WSF at least 50% of their working time. A self-addressed, stamped envelope was enclosed and the questionnaire mailed to the author's office. The questionnaire responses of individuals and the identities of the respondents remain confidential. Only grouped information is reported.

The WSF provided information of the number of absences from work due to illness (sickdays) during 1986 for all the masters, mates, and pilots. Sickdays include time loss for personal illness as well as on-the-job injuries.

The survey results were entered into a MacIntosh PC using REFLEX software for the database and STATVIEW software for the statistical analysis.

There were over 250 questions on the survey requiring responses. On several questions, there were one or two individuals who did not answer the question thus producing missing data. Since the total number of individuals was 93, and missing data occurred rarely (and for different individuals), the missing data was treated as a negative response for the purposes of the analysis. The total number of respondents therefore remained the same for discontinuous data. For continuous data, the missing data was eliminated and the total number for that response adjusted accordingly.

The proportion of those responding positively to each question was determined for the group of masters, mates, and pilots (MM&Ps) as a whole. Because it was difficult to make comparisons with other occupational groups of different ages, health, socio-economic, geographic, and other factors, some internal comparisons within the group of MM&Ps were made. Historically, there were some problems identified with the shift schedules on the Seattle-Bremerton run and for this reason, the responses of the Seattle-Bremerton run MM&Ps were compared to those of all other MM&Ps in the WSF.

Chi-square analysis was used for discontinuous data and the T-test was used for continuous data to determine whether differences noted between the two groups were statistically significant.

Because of their unpredictable schedules, responses of relief MM&Ps were also compared to all other MM&Ps in the same fashion as those on the Bremerton run. Again, because of subjective complaints of some of the MM&Ps on the Fauntleroy-Vashon run, the responses of these MM&Ps were also compared with all other MM&Ps to determine whether any significant

differences existed internally.

The results of the questionnaire survey appear in Part II of this report.

Finally, guidelines are given for the establishment of more physiologic shift schedules throughout the WSF based on the current literature and the results of the survey. An example of two such shift schedules for the Bremerton run appears in Appendix E.

PART I: REVIEW OF THE LITERATURE ON HEALTH EFFECTS OF SHIFT WORK

Almost every measureable physiologic indicator in humans has shown a circadian rhythm (or cyclical pattern). Sleep-wake patterns, body temperature, lung function, heart rate, blood pressure, secretion of hormones, urinary output and excretion of substances, function of white blood cells, secretion of enzymes, metabolic activity of bone, as well as emotional and intellectual functioning and sensory-motor performance exhibit cyclical pattern. Most of these hundreds of rhythms regulating biological functions follow a 24-25 hour cycle and respond to cues such as light dark cycles, meals and social interaction. When the circadian rhythms (or clocks in the brain) are disrupted as in shift work or jet travel, the rhythms adjust at different rates putting various body rhythms out of synchronization with each other.

The circadian periodicity alters alertness, response to medications, susceptibility to attacks of asthma, responsiveness of the white blood cells to viral challenge and many other functions.

Over 27% of male workers and 16% of female workers in the United States rotate between day and night shifts (Danchick, 1979). Studies of shift workers have shown that shift work, particularly night and rotating shift work, may have significant effects on workers' health, performance, and well-being through disruption of the workers' daily biological, or circadian rhythms (Moore-Ede 1985). Surveys have shown that rotating shift workers have a higher incidence of sick leave (Koller, 1983) and poorer scores on a variety of combined "health indices" (Smith, 1982). A number of factors affect workers' adjustment to shift work. Certain of these factors may be manipulated to improve worker adaptation to shift work.

Shift workers follow an irregular, often nocturnal schedule, periodically working at night and trying to rest and sleep during the day. Unfortunately, night shift workers (even permanent night workers) rarely, if ever, fully re-synchronize their circadian rhythms to their shift work schedule because they do not maintain regular daily hours of rest, meals and activity as they revert to diurnal schedules on their days off. In spite of this, research has shown some types of shift schedules are more effective in reducing worker dissatisfaction and health

complaints.

The de-synchronization of the workers' circadian rhythms by shift work is similar to the temporary de-synchronization termed "jet lag". The difference between shift work and jet travel, however, is that while jet travelers' circadian ryhthms soon re-synchronize to their new time zones, shift workers' circadian rhythms usually do not fully re-synchronize to their new work schedules before they must rotate shifts again. The need to adjust to the new shift rotation is frequent over many years rather than intermittent and occasional as in jet travelers. This persistent de-synchronization may eventually lead to diminished worker health and performance. Some have shown that workers who do not have sufficient time to adjust to a new shift schedule demonstrate dampening or flattening of several circadian rhythms such as body temperature. When the normal wave like pattern becomes flat, the result is a feeling of chronic fatigue and irritability and depression.

Standard epidemiological studies which examine worker illness, mortality, health clinic visits, and absentee rates, have not often provided an accurate reflection of shift workers' health because shift workers are a self-selected group (Frese, 1984). This self-selection factor plays an important role in determining which workers enter into and remain in shift work. Certain types of people are more likely to choose shift work because of the higher pay they receive for working evening and night shifts. Shift workers also tend to be younger (and thus healthier) because worker seniority systems usually move the older workers into daytime or supervisory positions. Finally, an estimated 20% of new shift workers return to day work because they do not tolerate the schedule changes required by shift work (LaDou, 1982). Thus the remaining shift worker may be quite different from the permanent day worker, making direct comparisons of their health less valid.

A useful method which avoids many of the problems of self selection, is to study former shift workers who leave shift work to work during the daytime. These "drop outs" have a greater number of sickness absences than those who remain and the effect persists for some time. In a recent study using this method (Frese, 1984), former shift workers were divided

into three groups: those who left shift work for primarily health-related reasons, those who left shift work for other reasons, and those who left shift work for combined health and other reasons. Of the 261 shift workers in the study, those workers who left for primarily health-related reasons had more than twice the number of health problems within the preceding two years. Those who fail to adapt have an unusually high incidence of sleep-wake disturbances, gastrointestinal and possibly cardiovascular pathology. Either the disease makes the individual less tolerant of shift work or shift work increases the incidence of the disease among predisposed individuals.

Despite the difficulties researchers encounter when studying shift workers' health, certain medical conditions and illnesses show consistently higher rates among night and rotating shift workers. Nurses on rotating shifts exhibited a significantly higher rate of clinic visits and took more sick days off for serious illness than nurses on permanent shifts (Colligan, 1979).

Those working night or rotating shifts were significantly more likely to complain (60%) of difficulty falling asleep, staying asleep, and staying awake at work (Rutenfranz). The length of daytime sleep is significantly shorter in night and rotating shift workers, and nighttime sleep after a return to daytime work is also disrupted (Tepes, 1981, Akerstedt, 1982). Noise and social conditions are important factors in sleep disruption during the day. Important stages of sleep (Stage 4 and REM sleep) are reduced in rotating shift workers. Thousands of sleep diaries of rotating shift workers showed that day sleep averages 3-5 hours in length (Rutenfranz, 1981). Almost every shift worker was fatigued or had problems sleeping at times but most usually felt better after a 2-3 day break when they could catch up on sleep. Those with more serious complaints had a more fragmented sleep-wake cycle that was not corrected by 2 or 3 days of rest. Sleeping pill use is also higher in night-shift workers (Reinberg, 1980) and this is also a factor in reduced alertness and the frequency of falling asleep at work. Difficulty falling asleep and staying asleep is correlated with body temperature which varies a few degrees throughout the day. When body temperature is low at night, it is easier to sleep. During the day, body temperature is high and sleep is

more difficult. Interestingly, although there is general agreement in the literature that sleep during the day is shorter and less refreshing than sleep at night, in most government regulations on work hours, that fact is not taken into consideration.

A number of studies comparing the health of rotating and night shift workers with that of day workers have found higher rates of gastrointestinal (GI) complaints and peptic ulcer disease (after 5 years of exposure) among rotating and night shift workers (Moore-Ede, 1985). Eleven out of sixteen such studies have shown higher rates of GI complaints and verified peptic ulcer disease. Common complaints include epigastric pain, decreased appetite and constipation. Some of the factors which appear to contribute to higher rates of GI disease include: the altered mealtime schedules required by shift work, shift workers' increased use of alcohol, caffeine and tobacco, and shift work's disruption of workers' regular circadian secretion of intestinal enzymes.

Psychoneurotic disorders also appear to occur more frequently among shift workers. In one study of textile workers, employees with exposure to night shift work, when compared to permanent day workers, were 5 to 15 times more likely to suffer from symptoms of anxiety and depression which required hospitalization or treatment with psychotropic drugs (Costa, 1980). Rockwell found increased reporting of depressive symptoms immediately following shift rotation. It is hard to know whether shift work helped cause the problems or if those with such problems already are more likely to work at night.

Higher rates of cardiovascular risk factors and disease have been associated with shift work (although no increase in cardiovascular mortality has been noted). A study of Swedish men showed that those men with a history of heart attack were significantly more likely to be shift workers than were age and sex-matched controls (Alfredson, 1982). A Norwegian study showed increased serum cholesterol levels in rotating shift workers. Orth-Gomer (1983), in a study of policemen, showed that the modification of shift rotation schedules to a clockwise direction significantly decreased the levels of triglycerides (fat in the blood), glucose (sugar), urinary excretion of catecholamines (hormones), and

systolic blood pressure (risk factors for cardiovascular disease).

There are some illnesses that may be affected by alteration in circadian rhythm due to shift work. The timing and dose of insulin may be critical in a brittle diabetic. There is a change in vital capacity throughout the day which may be of importance for those with respiratory (asthma) or cardiovascular disease. The rhythmic change in flow of urine and excretion of metabolites may be of importance in a worker with renal disease. Epileptic seizures tend to occur at certain times of the day and the threshold for seizure is lowered by sleep deprivation. Schizophrenic or paranoid behavior may be percipitated in a susceptible employee by lack of sleep. The metabolism and effectiveness of certain drugs is influenced by time of day (digitalis for heart disease is more effective at night).

Although shift work has been shown to influence morbidity (or illness) there are no studies indicating significant effect on shift worker mortality (or risk of dying). It has also been somewhat difficult to determine the effects of shift work on performance. While shift worker self-selection has hindered studies of shift worker health, studies of shift worker performance have been held back by union and management's fear of having the results of performance studies made public (Colligan, 1979). Despite these problems, there is evidence to show that worker performance may be impaired by shift work.

Significant reductions in shift worker performance occur primarily during the night shift (between 3:00-4:00 a.m., corresponding to the bottom of the cycle of body temperature), and have been demonstrated in telephone operators who show diminished response speeds, meter readers whose accuracy deteriorates, train engineers who fail to respond to alerting signals, and single-vehicle truck operators whose accident rates increase (Akerstedt, 1984). One study has shown that unprepared reaction time and four-choice reaction time were impaired at night and simple reaction time deteriorated with the number of days into the workshift in a group of workers on weekly rotating shifts (Tilley, 1982). A number of other studies indicate that errors generally increase at night. This increase is greater if the worker has already been working 4 or more hours before midnight. The highest error rates occur at night between 3 and 6

a.m. This nighttime dip in human performance has been seen in several studies using a variety of tests including calculation, memory, tracking and vigilance tasks. Additionally several studies show that performance declines as the number of hours of work increases.

Some authors have noted that shift workers participating in mental and repetitive work adapt to night work with more difficulty than those engaged in physical work, especially those involved in vigilance tasks under conditions of relative perceptual isolation or monotonous surroundings. Visual perception time is prolonged at night and the threshold for sensitivity to visual stimuli is increased (Makowska, 1972). This has particular significance for those involved in transporation.

Klein (1970) in a study of airline pilots under simulated flight conditions showed that the time required to make necessary adjustments to the correct position after occurrence of a simulated flight incident was longer at night and more errors were made in position at night. One recent example is a commercial passenger plane that was to land in Los Angeles but flew 150 miles out over the Pacific because all three pilots were asleep. Repeated radio announcements were required to wake them (Colman, 1984).

Two additional examples of impaired shift worker performance are the 1979 accident at the Three Mile Island (TMI) nuclear power plant and the recent report of a "night shift paralysis" among night workers. Studies of the accident at TMI, which occurred at 4:00 AM, have cited worker fatigue from a weekly rotating shift schedule as a possible contributing factor to the operator errors which precipitated the mishap (U.S. President's Commission Report, 1979; Ehret, 1980).

In a recent investigation of night nurses' circadian rhythms, (Folkard, 1984), 12% of the nurses reported that they had experienced temporary gross motor paralysis lasting an average of about four minutes, during which they were totally unable to move. The paralysis typically occurred in the early morning hours while the nurses were sitting at their desks, performing tasks such as reading or writing. While further

investigation of this "night shift paralysis" will be necessary to better document its occurrence, the safety implications of such a paralysis are disturbing especially for those workers employed in jobs dealing with the public safety such as in transportation.

With regard to rest periods and performance, many authors express opinions on the effect of cumulative fatigue on work performance, but there are few empirical studies of the amount of rest needed to overcome that fatigue. Some European researchers advocate a 24 hour rest period after every night shift. Workers, especially younger ones, often prefer long, rigorous work periods if they are eventually rewarded with a long rest period.

As to whether rotating shift workers have a higher on-the-job injury rate, there is conflicting evidence. On-the-job accidents do occur most frequently at the beginning of a new shift schedule. One study (Smith, 1979) of 1228 nurses over a 6 month period showed that nurses on a rotating shift schedule had significantly more injuries than those on fixed shift schedules. Another study has shown a higher incidence of accidents among shift workers, especially during off-duty hours (Lidell, 1982). Other studies have not demonstrated a higher injury rate among shift workers, although there is suggestion that the injuries that do occur may be more severe.

Shift workers sense of well-being, as defined by Akerstedt and Torsvall (1978), is "the self-reported prevalence of minor health problems associated with shift work." Instead of measuring actual disease, shift worker well-being focuses on subjective assessments of workers sleep, social life, irritation and strain, and psychosomatic complaints. One of the most common complaints voiced by shift workers is that shift work disrupts their social life. Studies have found shift workers to have significantly lower participation rates in social organizations, engage in more solitary activities, report higher incidences of family and sexual problems, and have higher rates of divorce than day workers (Dunham, 1977).

Shift workers also report higher levels of psychosomatic complaints

and approximately twice the number of complaints of irritation, fatigue and nervousness (Frese, 1984).

The inability of shift workers to adjust to shift work, and their diminished well-being may also be reflected in the higher rates of alcohol abuse that have been found in these workers. In a cross-sectional survey of Canadian workers, male shift workers reported twice as many serious drinking problems as male non-shift workers (Smart, 1979). Goldstein noted that shift workers often self-medicated in an attempt to compensate for trouble staying awake and trouble sleeping. Typically, they use large doses of caffeine while on duty and large doses of alcohol to go to sleep.

A related measure of shift worker well-being is job and shift schedule satisfaction. Shift workers typically report lower levels of job satisfaction and more complaints with their working hours. Two recent studies have also shown that shift workers prefer shift rotation schedules which follow circadian rhythm principles over schedules which do not take workers' biological rhythms into account (Czeisler, 1982; Orth-Gomer, 1983).

A number of factors appear to affect workers' adjustment to shift work. Some of the more important ones are: the type of shift schedule worked, the sequence and frequency of shift schedule changes, the degree to which workers adjust their social, dietary, and sleeping habits to coincide with their shift schedule, the degree to which workers on a particular shift have positive interpersonal interactions, and the age of the worker.

Workers generally do not have difficulty physiologically adjusting to evening shift work or to shift schedules which alternate between day and evening shifts, because circadian rhythm disruption is minimal. The type of shift work which does cause significant adjustment problems are rotating shift work which requires night duty.

The sequence and frequency of shift schedule changes has an important effect on worker adjustment. Rotating shift workers are less able to adjust to shift schedules which change more frequently than once every two

to three weeks (Czeisler, 1982). Periods of less than two to three weeks, apparently do not allow sufficient time for workers' circadian rhythms to re-synchronize to a new shift assignment. A rule of thumb is that it takes one day to adjust to a one hour change in time of going to bed.

Shift rotation schedules which are designed to change clockwise (days, evenings, nights) are better tolerated than shift rotation schedules which change counterclockwise (days, nights, evenings) (Rose, 1984). The underlying rationale for this clockwise scheduling method is that the human circadian system, when removed from the influence of regular daily schedules, also advances clockwise on an approximately 25-hour-per-day schedule. We can tolerate going to bed an hour or two later at night much better than getting up an hour or so earlier.

In a well-publicized study (Czeisler, 1982) in a potash factory in Utah, two-thirds of rotating shift workers complained of insomnia vs 20% of day workers. One-third fell asleep as often as once per week vs 6% of the day workers. On a schedule that rotated from days, to evenings, to nights every 21 days, the prevalence of insomnia and falling asleep at work approach that of day workers. The productivity of the shift workers increased 20%. Another group that worked 10 days on days, 4 days off, 10 days on evenings, 4 days off and 10 days on nights, followed by 4 days off also had less insomnia, fatigue and general health complaints.

Rapid rotation schedules, where shifts change daily or every other day, do not allow any time for workers' circadian rhythms to readjust and thus keep workers synchronized to their usual diurnal schedule. These schedules, while significantly impairing workers' performance during the night shift, appear to be somewhat less disruptive overall, and are often preferred by shift workers (Ehret, 1980). Rapid rotation schedules may not be advisable, however, in work settings where complex cognitive tasks and heightened worker attentiveness are required as on jobs dealing with the public safety in transportation.

Those shift workers working night and rotating shifts face the problem of how to schedule daily patterns of sleep, eating, and social activity. Day-to-day consistency in these patterns (such as eating the main meal of

the day at the same time each day) can help to foster adjustment to shift work (Minors, 1983). Studies of nurses on night duty indicate that those who cope most successfully develop styles of living (day and night) that offset the problems of shiftwork (Adams, 1986). This may be especially important on the worker's day off, when workers often return to their previous schedule or to those of family and friends.

Differences in tolerance to shift work can to a lesser extent be accounted for by individual differences in personality and circadian rhythms. Those scoring high on scales of neuroticism (Meers, 1978), introversion (Nachreiner, 1975), and "morning persons" (Akerstedt, 1976) are less likely to be able to tolerate shift work. Those who find it easy to overcome drowsiness, to sleep at unusual times, and those with high-amplitude circadian rhythms in body temperature and certain hormone excretion were better able to tolerate shift work and less likely to show flattening of certain of their circadian rhythms such as body temperature as a result of shift work.

Finally, age appears to affect adjustment to shift work. Studies show that older workers, particularly those over the age of 45, have greater problems adjusting to shift work (Akerstedt, 1981). Possible explanations for this relationship between age and adjustment may be found in studies of the circadian rhythm and sleep, which show increasing age to be associated with greater circadian asynchrony and sleep disruption (Collings, 1983). Older workers readjust their biological clocks and circadian rhythms less rapidly than younger workers. Younger workers may be able to trade a more physiological shift schedule for larger blocks of duty time with more free time off at the end of the cycle, while older workers cannot.

For many workers, shift work may be perceived as nothing more than an inconvenience, an obligation they must fulfill in order to meet the requirements of their job. For some workers, however, shift work represents a source of potential problems which may significantly affect the worker's health and ability to function effectively both on-the-job and at home. An extensive bibliography of articles on shift work, some of which are referenced above, appears in Appendix A.

One of the most important ways in which occupational health professionals can begin to improve the adjustment of shift workers is to assess their workplace's shift work schedules and determine how often shift assignments change and in what sequence. Shift rotation schedules that change weekly or more often and in a counterclockwise direction, should be modified within the constraints of the system to change less frequently and in a clockwise direction. The economic gains of physiologically and psychologically stressful shift work practice must be balanced against the identifiable human and social costs. It is difficult to quantitate such costs and benefits, and in finding out to whom they accrue.

Of particular concern are shift workers with preexisting health conditions that require special dietary and medication regimens. Workers with diabetes, asthma, epilepsy, hypertension, or thyrotoxicosis should be advised to consider permanent day or evening work, or otherwise be under the close supervision of an occupational health specialist who can prescribe medication and mealtime schedules specific to the worker's shift and lifestyle schedule. In addition, older workers, especially those over the age of 45, should receive special attention as they may also be more liable to experience problems adjusting to shift work.

During each shift assignment, workers should be encouraged to maintain, as much as possible, a regular daily schedule of activity and sleep, especially on workers' days off. Meals should be taken at approximately the same time each day, and provide a full balanced diet. Because shift work is stressful, workers should be taught to take special care in maintaining a healthy lifestyle, a lifestyle which includes regular exercise, proper diet, and sufficient restful sleep. Although shift work is necessarily stressful, that stress can be reduced by arranging shift schedules so they follow circadian rhythm principles and by teaching workers methods for improving their adjustment to shiftwork.

PART II: RESULTS AND DISCUSSION OF THE QUESTIONNAIRE SURVEY OF MASTERS, MATES, AND PILOTS OF THE WASHINGTON STATE FERRIES

Survey questionnaires were mailed to 121 members of the International Organization of Masters, Mates, and Pilots by the Washington State Ferries (WSF). Completed questionnaires were returned by 93 Union members (77%). This 77% response rate is quite high when compared to other questionnaire surveys of shift workers. There is always the possibility, however, that those who responded to the survey are different in some ways from those who did not respond.

A. Responses of Total Group of Masters, Mates, and Pilots

Responses of the licensed crew members (MM&Ps) as a whole to a number of questions on background, job information, illness and injury, alcohol and smoking, social, personal, sleeping and eating patterns, and incidents involving poor performance appear in Tables 1-14. There are, of course, numerous problems with comparing the responses of the MM&Ps with other studies of shift or nonshift workers because of variations in age, sex, socio-economic, cultural, geographic and other confounding factors. Only the most gross comparisons can be made. It was for this reason that several internal comparisons of questionnaire responses within the group of masters, mates, and pilots were made as discussed in Part B.

The average age of the masters, mates, and pilots (MM&Ps) that responded to the questionnaire was 44. They have worked for the WSF for an average of 16 years, have been on their current job an average of 8 years, on their current run 6 years, and on the current watch 3 years (Tables 1-2).

Fourteen (15%) consider themselves to be in fair or poor general health and 10 (11%) have been hospitalized in the past 6 months. Fifty-one (55%) use aspirin or its equivalent, at least 2-3 times per week, and 36 (39%) use antiacids at least 2-3 times per week (Tables 3-4). The use of aspirin and antiacids is somewhat higher than that observed in other shift workers (Tepas, personal communication, 1987).

Twenty-nine (31%) have had six or more symptoms of ill health in the past year. Twenty (22%) have been told by a physician that they had hypertension, 2 (2%) that they had heart disease, 8 (9%) that they had gastritis, 5 (5%) that they have stomach ulcer, and 10 (11%) have

consulted a physician for insomnia.

The prevalence of those who have been told by a physician that they have hypertension is higher than would be expected for a group of mostly caucasion males of average age of 44 (10%) (Statistical Abstracts, U.S., 1986). The prevalence of consultations with a physician for stomach ulcer, heart disease, asthma, respiratory problems, colitis, diabetes, epilepsy and other health problems in the MM&Ps as a whole was unremarkable. The number of MM&Ps consulting a physician for insomnia may be high but there is no good published data available for comparison.

Only two (2%) have experienced an on-the-job accident resulting in lost time in the past 6 months, while 9 (10%) have experienced an off-the-job accident in the past 6 months resulting in lost time. This is lower than that observed by Smith (1982) in the NIOSH survey. The average number of sick days taken from work in 1986 was 9.

Forty-eight (52%) drink alcohol on days that they also work and 24 (26%) drink 4 or more ounces of alcohol at one time when they do drink. Ten (11%) have noted an increase in the average amount of alcohol they have consumed in the past 6 months. Eight (9%) use alcohol frequently to get to sleep. Twenty-seven (29%) smoke cigarettes. Seven (8%) use medications to calm down at least 2-3 times per week, and 2 (2%) use medications to pep up at least 2-3 times per week.

The fact that 26% of the MM&Ps report that they drink 4 or more ounces of alcohol at one time when they do drink may be significant. While there is not enough data available from this questionnaire survey to determine the prevalence of alcohol abuse in this group, the above responses do indicate some suggestion that this may be of concern. A more detailed study of alcohol use among the MM&Ps is suggested to determine whether the prevalence of alcoholism may be higher than the 7-10% reported for most industrial groups. The prevalence of cigarette smoking in this group is slightly lower than other groups of males in this age range (Statistical Abstracts, U.S., 1986).

Eighteen (19%) of the MM&Ps are divorced or separated. Fifty-five (59%)

of the spouses dislike the work schedule. Sixty-four (69%) of the MM&Ps feel they receive good support from family, co-workers, and friends, and 58 (63%) have someone who they can talk to on a regular basis about their feelings. Twenty-eight (30%) are dissatisfied with the amount of time they have to devote to hobbies, and 56 (60%) are dissatisfied with the amount of time they have for involvement in outside groups. Thirty-four (37%) are dissatisfied with the amount of time they can devote to their families. Thirty (32%) are dissatisfied with the amount of time they can devote to their children if they have any. Fifty-one (55%) complain that their schedule often interferes with sex.

Forty-five (48%) of all MM&Ps are dissatisfied with their current work schedule. Fifty-three (57%) of the families are dissatisfied with the MM&Ps members work schedule. Fifty-three (57%) of the MM&Ps say they work overtime during a typical month. The average number of hours per week spent deadheading (riding on ferries to get back and forth to work) is 3 hours.

The above responses are comparable to other studies of the impact of rotating and night shift work on social and personal well being (Wedderburn, 1981). The percent of this group that is divorced or separated is comparable to the divorce prevalence among night shift workers, which is somewhat higher than day shift workers (Tepas, 1985), and higher than the general population of males in this age range (Statistical Abstracts, U.S., 1986).

The majority 88 (95%) of the MM&Ps like their work. Ninety-two (99%) of the MM&Ps consider themselves to be good workers and 92 (99%) like their co-workers. This finding is in contrast to most studies of shift workers in which dissatisfaction with the work often correlates with dissatisfaction and decreased sense of well being attributed in large part to the shift work schedule. This positive finding suggests that improvement in shift schedules throughout the WSF may well be accompanied by significantly increased satisfaction with work in general among the licensed deck crew members (and their families).

Thirty-three (36%) of the MM&Ps wake up 3 or more times per sleep

session. Thirty-seven (40%) frequently have difficulty getting back to sleep once they wake up. Fifty-one (55%) have a different sleeping pattern for each shift. Sixty-nine (75%) feel tired at work at least 2-3 times per week. Only 3 (3%) frequently use medications to get to sleep. Forty-two (45%) have problems with feeling tired on the night shift. Forty (43%) state that it takes a week or more to adjust to a new shift. Thirty-three (36%) describe a poor sleep pattern overall. The mean number of hours of sleep per day is 6.2 hours and the mean difference between their stated ideal amount and the actual amount is 1.9 hours per day (highly significant). This last question may be unreliable as several sleep researchers have found that the number of hours of reported sleep often differs considerably from actual sleep as measured by electroencephalogram.

The above results are comparable to other studies of shift workers which indicate sleep disturbances in approximately 15-20% of day workers, and in 30-80% of shift workers doing rotating night shift and 40-60% of workers on permanent night shift (Rutenfranz, 1981 and Tepas, 1985). The mean number of hours of sleep is comparable to that of shift rotators in the food processing industry (Smith, 1982) and lower than that of day workers. The proportion reporting feeling tired at work at least 2-3 days per week is higher than night shift workers studied by NIOSH using the same questionnaire (Smith, 1982). This reporting of poor sleep pattern, as reflected in the greater frequency of awakening during sleep and having trouble getting back to sleep once awakened, may be reflective of psychological mood disorders, environmental factors, or disturbances of circadian rhythms. More detailed sleep studies would be necessary to determine actual prevalence and cause of the reported sleep disturbances.

Forty-nine (53%) of the MM&Ps eat less than three meals per day, and 67 (72%) eat less than one meal per day with their family. Sixty-one (66%) say their eating pattern varies with each shift and 15 (16%) do not have a good appetite. Fifty (54%) snack once per day or more and 37 (40%) are quite dissatisfied with their eating pattern. Thirty-five (38%) say that it takes at least a week to adjust to a new meal pattern.

Clearly, shift work schedules of the MM&Ps interfere with the social

interaction that sharing meals with family and friends affords.

On their current watch, 6 (7%) of the MM&Ps stated they have been involved in a ferry accident. Two of those accidents were reported to have been related to fatigue. Thirty-one (33%) of the MM&Ps reported having had near misses on their current watches, and 18 (20%) reported having had near misses where fatigue was an important factor.

Twenty-one (23%) reported errors of judgement on their current watch, and 18 (20%) reported errors of judgement where fatigue was a factor. Forty (43%) of the MM&Ps reported falling asleep at work on their current watch and 21 (23%) reported falling asleep at work on their current watch as often as once per month. It should be noted that the survey questionnaire asked about falling asleep on the current watch but did not differentiate between falling asleep at the controls of the ferry vs. falling asleep in the cabin while being relieved by the other licensed crew member. Six (7%) have had auto accidents on their current watch due to falling asleep at the wheel and 39 (42%) of the MM&Ps have had near misses in their auto while working on their current watch that they feel were related to fatigue.

Since the MM&Ps are responsible for the operation of ferries carrying hundreds of passengers, and vigilance and good judgement are essential at all times, the above findings are disturbing. The self reports of the above incidents certainly seem higher than would be acceptable to management or the ridership.

B. Internal Comparisons of Responses of Masters, Mates, and Pilots

When the responses of the MM&Ps on the Bremerton run were compared to all other MM&Ps responses, a number of differences were noted. The average number of days lost from work due to illness in 1986 was 13 versus 9 for the other MM&Ps, a difference that was statistically significant (Table 3).

Although age may confound this difference, the Bremerton MM&Ps were on the average only one year older than the other MM&Ps (Table 1) and the

differences in age, number of years with the WSF, and on their current job, run, and watch were not statistically significant. The number of women was also not significantly different for this group (Table 1). The number of Bremerton run MM&Ps who considered themselves to be in fair or poor general health, to have hypertension, heart disease, respiratory and other health problems, and the number who had been hospitalized in the past 6 months, smoked cigarettes or consumed greater than 4 ounces of alcohol on days they did drink was not significantly different than the other MM&Ps. This suggests that the difference seen in sickdays may not be related to poor general health and that, perhaps, fatigue was a factor.

No greater proportion of MM&Ps on the Bremerton run drink alcohol on work days, drink more alcohol on days they do drink, use alcohol to get to sleep, smoke cigarettes, or use medications to calm down or pep up compared to the other MM&Ps (Table 5). There was actually a trend toward less use of alcohol, smoking, and drugs on the Bremerton run although the difference was not statistically significant. These findings are in contrast to several studies in the literature suggesting increased alcohol use and smoking among rotating shift workers. Perhaps these findings represent an adaptation of the MM&Ps on the Bremerton run to the extremely variable shift schedules (or selection) since both alcohol use and smoking are known to interfere with sleep.

In Table 7, there were not striking differences between responses of MM&Ps on the Bremerton run and other MM&Ps to questions dealing with social and personal factors. It is noteworthy, however, that MM&Ps on the Bremerton run are significantly more dissatisfied with their schedule than the other MM&Ps. They also tended to report more that their schedule often interfered with sex (not statistically significant).

In Table 9, it is seen that significantly more MM&Ps on the Bremerton run report difficulty going back to sleep once they wake up and feel tired at work at least 2-3 times per week or more. Significantly more MM&Ps on the Bremerton run state that their sleep pattern in general is poor. Their mean difference between actual and ideal number of hours of sleep per night was 2 hours which is not much different than that of other MM&Ps. Thirty-six percent of the Bremerton MM&Ps had consulted a physician for

insomnia versus 7% of the other MM&Ps, a difference that was statistically significant (Table 9). These findings do suggest more sleep difficulties among MM&Ps on the Bremerton run. Admittedly, these questions on sleep are quite general and it is difficult to say with certainty whether the Bremerton MM&Ps suffer from more sleep disturbances than the others in the absence of more detailed sleep studies.

In Table 11, except for the fact that the eating pattern of the MM&Ps on the Bremerton run is reported to vary with each shift, there are no significant differences between MM&Ps on the Bremerton run and other MM&Ps in regard to number of meals per day, appetite, snacking, number of meals with the family or friends, dissatisfaction with eating pattern, or time to adjust to a new eating pattern. The proportion of MM&Ps on the Bremerton run who have been told by a physician that they had gastritis or peptic ulcer is also not increased.

In Table 13, it is seen that a significantly greater proportion of MM&Ps on the Bremerton run state they have experienced errors of judgement on their current watch and a highly significant proportion state they have experienced errors of judgement where fatigue was a factor. Significantly more MM&Ps on the Bremerton run report near misses on their current watch they believe are related to fatigue than do the other MM&Ps. A greater proportion of MM&Ps on the Bremerton run have had a ferry accident on their current watch that they feel was related to fatigue, but this result was not statistically significant.

These reports suggest that fatigue may well be a factor resulting in potentially serious errors of judgement and probably increasing the risk of ferry accidents occurring among the MM&Ps on the Bremerton run.

When relief MM&Ps were compared to all other MM&Ps, few differences were noted. They were, on the average, 3 years younger and had been on their current job 2 years less, but these differences were not statistically significant.

The relief MM&Ps had significantly fewer average number of sick days in 1986 (7) than did the other MM&Ps (9). Some relief workers stated during

the interviews that they don't answer the phone, or may not be called when they are not feeling well, so that this finding is difficult to interpret.

There are no significant differences in alcohol, smoking or medication use when relief MM&Ps were compared to the other MM&Ps (Table 6). The same was true for the responses to questions dealing with social and personal issues in Table 8. The average number of hours spent deadheading was significantly increased in relief MM&Ps (5 vs. 2 hours).

In Table 10, it is seen that significantly more relief MM&Ps have a different sleeping pattern for each shift and complain of feeling tired on the night shift than do the other MM&Ps. In Table 12, it is seen that more relief MM&Ps have a different eating pattern for each shift than do the other MM&Ps.

Relief MM&Ps do not report a higher incidence of ferry accidents or errors of judgement on their current watch. They do report significantly more auto accidents on their current watch due to falling asleep at the wheel than do other MM&Ps.

No significant differences in the variables reported in Tables 1-14 were noted when the responses of the MM&Ps on the Vashon-Fauntleroy run were compared to responses of all other MM&Ps.

CONCLUSION

The MM&Ps report more hypertension, alcohol use on days they do drink, divorce, and dissatisfaction of MM&Ps and their families with their work schedules, the amount of time they can schedule for friends, family, children, hobbies, outside groups, meals with family and friends, and sex than non-shift workers. A large proportion of the MM&Ps report sleep disturbances and the average number of hours of sleep reported per night is 2 hours less than the "ideal" of 8 hours. The majority are tired at work 2-3 times a week or more. In spite of all of this, the overwhelming majority of the MM&Ps like their work and their co-workers.

There have been ferry accidents on the MM&Ps current watches related to fatigue. The large proportion of MM&Ps who report near misses, errors of judgement, and falling asleep at work as often as once per month, auto accidents and near misses related to falling asleep at the wheel, has serious implications for the safety of the public ridership of the ferries and the deck crews.

Some of the most erratic shift schedules occur on the Bremerton-Seattle run. When internal comparisons were made with all other shift workers, this group of MM&Ps reported significantly more sick days during 1986, more dissatisfaction with their current schedule, poor sleep pattern, and consultations with a physician for insomnia. This group also reported significantly more errors of judgement and near misses on their current watches they believed were related to fatigue.

Changes in the current shift schedules, particularly on the Seattle-Bremerton run, are recommended to prevent increased sickdays, sleep disturbances, disruption of family and social life of the crew members, and the serious potential for accidents related to fatigue affecting the public safety.

Suggested guidelines for the development of more physiologic and socially acceptable shift schedules appear in the following section. It would be desirable to re-evaluate this population by questionnaire survey in 1-2

years, after changes are made in the shift schedules, to determine whether such changes have had a positive effect on the areas of concern identified in this survey.

PART III: INTERVIEW AND WRITTEN COMMENTS REGARDING SHIFT WORK

TABLE 1
Demographics

VARIABLE	RUN		
	Bremerton	Other	Total
Number in each group	11	82	93
Average age	45	43	44
Number of women	1	3	4
Average years with Washington State Ferries	14	16	16
Average years on current job	7	9	8
Average years on current run	6	6	6
Average years on current watch	2	3	3

TABLE 2
Demographics

VARIABLE	RUN		
	Relief	Other	Total
Number in each group	17	76	93
Average age	41	44	44
Number of women	1	3	4
Average years with Washington State Ferries	16	16	16
Average years on current job	7	9	8
Average years on current run	8	6	6
Average years on current watch	4	3	3

TABLE 3
Illness/Medication/Injury

VARIABLE	RUN		
	Bremerton	Other	Total
Number in each group	11	82	93
Fair or poor general health	3	11	14
Hospitalized in past 6 months	1	9	10
Use aspirin several times every week	7	44	51
Use antiacids several times every week	2	34	36
Have six or more symptoms frequently	3	26	29
Hypertension	3	17	20
Heart disease	2	0	2
Gastritis	1	7	8
Stomach ulcer	1	4	5
On-the-job accidents in past 6 months with lost time	0	2	2
Off-the-job accidents in past 6 months with lost time	2	7	9
Average number of sick days in 1986	13*	9	9

*t-test, p less than or equal to .05

TABLE 4
Illness/Medication/Injury

VARIABLE	RUN		
	Relief	Other	Total
Number in each group	17	76	93
Fair or poor general health	2	12	14
Hospitalized in past 6 months	2	8	10
Use aspirin several times every week	9	42	51
Use antiacids several times every week	5	31	36
Have six or more symptoms frequently	3	26	29
Hypertension	3	17	20
Heart disease	0	2	2
Gastritis	1	7	8
Stomach ulcer	0	5	5
On-the-job accidents in past 6 months with lost time	0	2	2
Off-the-job accidents in past 6 months with lost time	2	7	9
Average number of sick days in 1986	7*	10	9

*t-test, p less than or equal to .05

TABLE 5
Alcohol/Smoking/Drugs

VARIABLE	RN		
	Bremerton	Other	Total
Number in each group	11	82	93
Drinks alcohol on work days	4	44	48
Alcohol use 4 oz. or more on days that worker does drink	1	23	24
Amount of alcohol use in past 6 months has increased	1	9	10
Use alcohol to get to sleep frequently	0	8	8
Smoke cigarettes	5	22	27
Use medications to calm down several times every week	0	7	7
Take medications to pep up several times per week	0	2	2

TABLE 6
Alcohol/Smoking/Drugs

VARIABLE	RUN		
	Relief	Other	Total
Number in each group	17	76	93
Drink alcohol on work days	13	35	48
Alcohol use 4 oz. or more on days that the worker does drink	5	19	24
Amount of alcohol use in past 6 months has increased	1	9	10
Use alcohol to get to sleep frequently	2	6	8
Smoke cigarettes	5	22	27
Use medications to calm down several times every week	1	6	7
Take medications to pep up several times per week	0	2	2

TABLE 7
Social/Personal

VARIABLE	RUN		
	Bremerton	Other	Total
Number in each group	11	82	93
Divorced or separated	3	15	18
Spouse dislikes schedule	6	49	55
Have very good support from family, friends, or coworkers	7	57	64
Have people with whom can talk about feelings	7	51	58
Dissatisfied with amount of time for hobbies	3	25	28
Dissatisfied with time for outside groups	7	49	56
Dissatisfied with time for family	4	30	34
Dissatisfied with time for children	5	25	30
Dissatisfied with schedule	9*	36	45
Family dissatisfied with schedule	7	42	49
Work overtime	9	44	53
Average number of hours deadheading per week	0	3	3
Like their work	10	78	88
Are good workers	10	82	92
Like their coworkers	11	81	92
Schedule often interferes with sex	9	42	51

*chi-square, p less than or equal to .02

TABLE 8
Social/Personal

VARIABLE	RUN		
	Relief	Other	Total
Number in each group	17	76	93
Divorced or separated	6	12	18
Spouse dislikes schedule	9	46	55
Have very good support from family, friends, or coworkers	13	51	64
Have people with whom can talk about feelings	12	46	58
Dissatisfied with amount of time for hobbies	6	22	28
Dissatisfied with time for outside groups	13	43	56
Dissatisfied with time for family	5	29	34
Dissatisfied with time for children	3	27	30
Dissatisfied with schedule	6	39	45
Family dissatisfied with schedule	9	40	49
Work overtime	10	43	53
Average number of hours deadheading	5*	2	3
Like their work	17	71	88
Are good workers	17	75	92
Like their coworkers	17	75	92
Schedule often interferes with sex	8	43	51

*t-test, p less than or equal to .05

TABLE 9
Sleep Patterns

VARIABLE	RN		
	Bremerton	Other	Total
Number in each group	11	82	93
Wake up 3 or more times per night	6	27	33
Sleeping pattern different for each shift	7	44	51
Frequently have trouble getting back to sleep	8**	29	37
Feel tired at work at least 2-3 times per week	11*	58	69
Frequently use medications for sleep	1	2	3
Describes poor sleep pattern	7*	26	33
Feel tired on night shift	8	34	42
Time to adjust to a new shift schedule is one week or more	5	35	40
Mean number of hours of sleep per day	5.9	6.2	6.2
Difference between ideal and actual sleep time per day in hours	2.0	1.9	1.9
Have consulted a physician for insomnia	4**	6	10

**chi-square, p less than or equal to .02
* chi-square, p less than or equal to .05

TABLE 10
Sleep Patterns

VARIABLE	MEN		
	Relief	Other	Total
Number in each group	17	76	93
Wake up 3 or more times per night	4	29	33
Sleeping pattern different for each shift	14*	37	51
Frequently have trouble getting back to sleep	2	35	37
Feel tired at work at least 2-3 times per week	11	58	69
Frequently use medications for sleep	1	2	3
Describes poor sleep pattern	5	28	33
Feel tired on night shift	13*	29	42
Time to adjust to a new shift schedule is one week or more	11	29	40
Mean number of hours of sleep per day	6.2	6.2	6.2
Difference between ideal and actual sleep time per day in hours	1.9	1.9	1.9
Have consulted a physician for insomnia	1	9	10

*chi-square, p less than or equal to .01

TABLE 11
Eating Patterns

VARIABLE	RUN		
	Bremerton	Other	Total
Number in each group	11	82	93
Eat less than 3 meals per day	7	42	49
Eating pattern varies with each shift	11*	50	61
Have fair or poor appetite	3	12	15
Snack once per day or more	7	43	50
Eat less than one meal per day with family	7	60	67
Dissatisfied with eating pattern	6	31	37
Takes a week or more to adjust to a new meal pattern	6	29	35

*chi-square, p less than or equal to .02

TABLE 12
Eating Patterns

VARIABLE	RUN		
	Relief	Other	Total
Number in each group	17	76	93
Eat less than 3 meals per day	10	39	49
Eating pattern varies with each shift	16*	45	61
Have fair or poor appetite	1	14	15
Snack once per day or more	10	40	50
Eat less than one meal per day with family	12	55	67
Dissatisfied with eating pattern	7	30	37
Takes a week or more to adjust to a new meal pattern	8	27	35

*chi-square, p less than or equal to .01

TABLE 13
Incidents

VARIABLE	RUN		
	Bremerton	Other	Total
Number in each group	11	82	93
Have had a ferry accident	1	5	6
Have had a ferry accident where fatigue was a factor	1	1	2
Have had near misses	6	25	31
Have had near misses where fatigue was a factor	5	13	18
Have made errors of judgement	7**	14	21
Have made errors of judgement where fatigue was a factor	7***	11	18
Have fallen asleep at work	5	35	40
Have fallen asleep at work more than once per month	1	20	21
Auto accidents on current watch due to falling asleep at the wheel	0	6	6
Near misses in auto on current watch related to fatigue	8*	31	39

***chi-square, p less than or equal to .001
** chi-square, p less than or equal to .01
* chi-square, p less than or equal to .05

TABLE 14
Incidents

VARIABLE	RUN		
	Relief	Other	Total
Number in each group	17	76	93
Have had a ferry accident	1	5	6
Have had a ferry accident where fatigue was a factor	1	1	2
Have had near misses	5	26	31
Have had near misses where fatigue was a factor	4	14	18
Have made errors of judgement	2	19	21
Have made errors of judgement where fatigue was a factor	2	16	18
Have fallen asleep at work	8	32	40
Have fallen asleep at work more than once per month	4	17	21
Auto accidents on current watch due to falling asleep at the wheel	3*	3	6
Near misses in auto on current watch related to fatigue	9	30	39

*chi-square, p less than or equal to .05

Masters, mates, and pilots were asked what they like and dislike about their current or previous shift schedules with regard to health, family and social life, job performance, and well-being. Comments are summarized below:

Like:

Their work and their co-workers

Having four days off after working 10 days on touring watch

Having 24 hours off after working 16-17 out of the previous 24 on the touring watch

Having reduced deadheading time on touring watches

Time off during the day, during the week for running errands

Avoidance of weekend crowds for recreational activities

The challenge of relief work because of different boats, runs, crews, and conditions

Personal quiet time away from work and family

Changing, unpredictable schedules

Good pay and number of hours of work per two week period

Permanent shifts or alternate day and afternoon shifts

Not having to deal with crew politics

Working as a team and having others to depend on

Several indicated no problems with the current shift schedule

Dislike:

Being consistently out of phase with friends and family with regard to energetic time and sleep times

Relief workers cannot plan time with family or friends because they may be called and may not know they have the day off until late in the day

Having to spend nights away from home

Not being able to sleep during the day at home due to family activities, neighborhood noise, phone calls, etc.

Not being able to spend time with spouse and children and feeling out of touch and out of control at home

Feeling fatigued most of the time and requiring nearly all of the 48 hours on days off to recuperate leaving little energy for life outside of work

On the touring watches there is a limited amount of time between watches and not enough time for transportation home, unwinding, and sleeping adequately before having to return to work

Statements that there are inadequate sleeping facilities on the boats as the boats may be running, the other crew making noise, the lockers rattling, the engineers working on the boat, the horn blaring every 15-30 minutes, and other distractions

Working 10 days in a row

Going to work at 4-5 widely varying times every week and finishing work at widely varying times

Deadheading on days off so that one doesn't really have the full day off

Statements that the alcoholism and divorce rate is higher among ferry workers than any other government employees in the State

Concern that vigilence and altertness is impaired by fatigue

Concern about increased irritability, and poor attitude when dealing with passengers and other crew members due to fatigue

Concern about errors of judgement, near misses and actual accidents on the ferries related to fatigue

Impaired ability to exercise, eat well-balanced meals, and get adequate sleep due to erratic shift schedules

Feeling tired, irritable, depressed and out-of-sorts most of the time

Concern about increased smoking and alcohol use due to fatigue and erratic shift schedules

Lack of regular schedule, no matter whether day, night or afternoon shift

Feeling abandoned by friends with whom one cannot plan activities and who are afraid to call due to possible waking the crew member

Falling asleep at the controls on the ferry for brief periods

Increased consumption of snack foods and other high calorie foods for convenience due to lack of a consistent meal pattern with resulting weight gain

Some feel they have had increased respiratory tract infections and gastrointestinal illness

Some feel current shift schedules are a form of "punishment" due to adversarial relations between unions and management at the WSF

Not being able to plan any educational or career advancement activities outside of work due to lack of a consistent schedule

Some would take less money and less hours for more consistent scheduling of work shifts

Older crew members that have high seniority may still end up on erratic shift schedules involving night work

PART IV: GUIDELINES FOR DESIGNING SHIFT SCHEDULES

A. Fixed vs. Rotating Shifts

There are many arguements in the literature for maintaining fixed shift schedules (which assume that there is fairly complete re-synchronization of circadian rhythms to the new shift schedule). Even permanent night workers, however, have more health problems than permanent day workers. A decision to implement fixed vs. rotating shift schedules must take into account a number of personnel variables that are outside the scope of this study. From a health and performance standpoint, there is currently not enough information in the literature to recommend fixed shifts over shifts that rotate slowly in a forward direction as described below.

B. Hours Worked in a 24-hour Period

Since the literature shows that performance generally does decline with an increase in the number of hours of continuous work, keeping the shifts to as close to 8 hours as possible is recommended.

Errors increase at night, especially if the worker has already been working four or more hours before midnight. For this reason, shifts should end and begin before midnight. Since longer hours and night work would be expected to have a synergistic effect on performance, night or graveyard shifts should not be more than eight hours in duration.

C. Direction of Shift Rotation

The literature is clear on the fact that the beginning time for each shift, on a rotating schedule, should rotate to later times with each change. In other words, the shift rotation should proceed from morning, to afternoon, to night work.

D. Duration of Each Shift Rotation

Recent literature indicates that slow rotation is usually preferable to fast rotation (although some of the European literature favors

rapid rotation of 1-2 days followed by longer rest periods after the night shift). Since it takes most people at least a week to accommodate to a new shift that starts 8 hours later than the previous shift, several weeks on the same shift allows the worker to re-synchronize body rhythms and social schedules on that shift for a reasonable period of time before having to go through the process again. Shift schedules that rotate in a forward direction every 3-4 weeks have been successful in increasing and sustaining worker satisfaction and productivity in one recent U.S. study. A shift schedule that rotates every 4 weeks for the Bremerton run is presented in Appendix E.

E. Recommendations Regarding Occasional Night Shift Work

Those workers that must work an occasional night shift, and who have not had a week or more to accommodate to night shift work, should have at least 24 hour off after the night shift. These workers should not work more than 1-2 night shifts in a row. This recommendation is supported by the European literature, in which rapidly rotating shift schedules are common.

F. Number of Days of Continuous Work

Many workers prefer longer continuous work periods (6-10 days at a time), if they are rewarded with longer rest times (3-4 days) at the end of the work period. Long work periods are usually preferred by younger workers, however. It is not recommended that 10 day work schedules be implemented for night shift work, because of the association of increased accidents with the number of successive days on the night shift.

G. Hours of Rest Between Work Periods

Because of time required for travel to and from work, meals, social or leisure activities, and 7-8 hours of sleep, the recommended amount of time between work shifts (of 7 or more hours in length) is at least 12 hours, and preferably 16 hours. This recommendation is particularly

appropriate for those deck crew members that must spend part of their time deadheading.

H. Worker Selection

Because of the greater circadian asynchrony, sleep disturbances, and health problems associated with age, it is recommended that workers over the age of 45 not be assigned to night shift work involving rapid (less than 3 weeks) rotation. Where possible, older workers should be assigned to regular day or afternoon shifts.

If permanent night shifts are implemented, an attempt should be made to select night shift workers who may prefer night work because they are more physiologically and socially suited to it (evening rather than morning types, single parents, etc.), rather than selection on the basis of other factors such as seniority.

Of concern, are workers with health conditions such as diabetes, asthma ,epilepsy, peptic ulcer disease, moderate to severe hypertension, or thyrotoxicosis. These workers should be evaluated by a physician, knowledgable as to potential health effects of shift work on health, medication effectiveness, job and performance requirements of the deck crew member, before assignment to shifts involving night work.

About 20% of shift workers will have difficulty adapting to shift work for a variety of reasons. Except for those factors mentioned above, it is difficult to predict before assignment to shift work which workers will have significant difficulty requiring reassignment to a different job or work schedule. Since a reliable screening tool has not yet been devised, preplacement screening of deck crew members is not recommended at this time. Early evaluation of deck crew members, identified as possibly experiencing health problems related to their shift work schedules, by a physician knowledgable as to the potential health effects of shift work, and the job demands and performance requirements of the deck crew members, is recommended to prevent lost time, safety hazards, and potential health consequences of shift work.

I. General Comments

During each shift assignment, the deck crew members should be encouraged to maintain, as much as possible, a regular daily schedule of activity and sleep, even on days off. Meals should be taken at approximately the same time each day, and provide a balanced diet. Because shift work, particularly night work, is stressful, the deck crew members should be encouraged to take special care in maintaining a healthy lifestyle which includes regular exercise, balanced diet, and sufficient restful sleep, moderate use of alcohol and coffee, and no cigarette smoking.

If the above recommendations are implemented, the health and well being of the deck crew members should be re-evaluated after a period of time to assess the effectiveness of the above measures in reducing the concerns identified in the present survey.

ACKNOWLEDGEMENTS

The management of the WSF: Elton Eilert, David Rice, David Black, Steve Smith and staff, Rose Musser and other for their cooperation and assistance in facilitating this project and gathering the necessary information. The Masters, Mates, and Pilots that took their own time to fill out the survey and respond to interviews. Captain Robert Davis. Captain Tom Jacobs for his persistent efforts to facilitate the project, increase questionnaire returns, and his (and Steve Smith's) design of an example schedule for the Bremerton-Seattle run. Susan Stewart and Allison Turner for clerical support.

PATRICK J. SPARKS, M.D., M.P.H.

DIRECTOR, OCCUPATIONAL HEALTH SERVICES
PROVIDENCE MEDICAL CENTER

OCCUPATIONAL AND
ENVIRONMENTAL MEDICINE
INTERNAL MEDICINE

SEATTLE MEDICAL SURGICAL CENTER
PROVIDENCE PROFESSIONAL BUILDING
930 10TH AVE., SUITE 100
SEATTLE, WASHINGTON 98122
329-0300

April 14, 1988

Elton Eilert
Employee Relations Director
Washington State Ferries
Colman Dock/Pier 52
Seattle, Washington 98104

Dear Mr. Eilert;

In my 1987 Literature Review and Survey of the Health Effects of Shiftwork among the Masters, Mates and Pilots of the Washington State Ferries, I made recommendations for changing the watch schedules which are summarized as follows:

- If watch schedules are to rotate, they should do so in the direction of later hours (morning to afternoon to night). The crew should remain on a particular watch long enough to accommodate physiologically (which is usually 3-4 weeks).

- Effort should be made to keep the hours of work at 8 or less, especially on the night watch.

- Errors increase at night, especially if the worker has already been working 4 or more hours before midnight. Watches should end before midnight and begin less than 4 hours before midnight.

- The greater the number of days of continuous work, the greater the number of days of rest should be. There may be decreased performance with greater numbers of days of continuous work on the night shift.

- The crew that is required to work an occasional night watch (if this is not their regular watch) should have 24 hours off after that watch. The crew should not work more than 2 consecutive night watches (unless they will remain on the night watch for several weeks).

- There should be enough hours between the watches to allow for travel, meals, and 8 hours of sleep. Twelve to 16 hours is suggested.

- Those members of the crew with chronic medical problems such as severe hypertension, heart disease, asthma, kidney problems, diabetes, etc. should consult their physician, or a physician knowledgable in the health effects of shiftwork, regarding any probable adverse interaction of their current shift schedule with their chronic illness or required medications.

- All crew members engaged in rotating watches should assume responsibility for obtaining regular exercise, eating a well-balanced diet, stress management, smoking cessation, and control of alcohol or drug misuse or abuse. The WSF should promote and facilitate that effort.

Given the above guidelines, I had an opportunity to review the watch schedule changes that were placed in effect for the Bremerton-Seattle runs on October 18, 1987. These are summarized in the attachments. I will comment on each of the watches as follows:

A Watch: This watch allows for physiologic accommodation to night work and follows the recommendation of more days off for more than 5 days of continuous work. The night watch is also not more than 8 hours in length. There is some possibility of reversion to a more socially acceptable night-time sleep schedule during the four days off and the crew should be encouraged to maintain the same sleeping schedule as when on the A Watch on their days off. (There is the possibility that some crew members may have difficulty with the 10 continuous days of night work if they have switched to regular night sleeping on their days off.)

B Watch: This watch is consistent with the recommendation for more days off for more than 5 days of continous work and the watch remains constant. Since it is a day watch, there should be little problem with change in sleeping schedule during the four days off.

C Watch: This watch works 4 days on a late night watch, starting after midnight (at 1 a.m.), shifts forward to a day watch starting at 9 a.m., then has 2 days off. The crew then works 4 days on an early day watch, followed by one day on a regular day watch. The shifts in the watches are in the right direction,

although the change from night to day occur too frequently to allow complete physiologic accomodation. This effect is counterbalanced by the fact that the watch has only two consecutive 8 hour night watches and the rest of the watches occur during the day. Weekends off also allow for more normal patterns of family and social interaction.

D Watch: This watch is consistent with the recommendation for more days off after more than 5 days of continuous work. The watch does shift after 5 days from late afternoon to late evening and the shift is in the right direction. The major problem with this watch is that there are 5 consecutive days in which the watch works its final 2 hours after midnight increasing the possibility of decreased performance during that time. During the four days off most of the crew should be able to maintain a similiar sleep pattern as when working. This would require going to sleep consistently around 3 or 4 a.m., however, which may interfere with sleep duration and family life in much the same way that night work does.

E Watch: This watch is very similiar to the D Watch and the above comments are applicable.

F Watch: This crew works late evening for two days, performing the final 2 hours of work after midnight. It then shifts to afternoons for two days, then to a day watch for one day. This is followed by two days off when presumably the crew will be active during the day and sleeping at night. Although the rotation in this watch is in the wrong direction, and it does not allow sufficient time for physiologic accommodation, it nevertheless involves only two consecutive days of watches extending past midnight. This watch may interfere with normal patterns of social or family life on the weekends, but allows over 2 days off during the week.

A copy of the watch schedules for the Seattle-Bremerton runs prior to October 18, 1987 are also attached. The changes made in the watch schedules reflected above represent a **significant improvement** over the schedules in effect prior to that date.

In general, the watches have been reduced to a consistent 8 hours. The rotation of the watches are in the right direction. There is much less rapid rotation, especially from late night to early morning. There is more consistency in the schedules to allow for scheduling of family and social or other activities. Those on the night shift are given time to accommodate to night work. Those that do not have time to accommodate to night duty work no more than 2 consecutive night watches. There are four days off in a row after 10 days of continuous work.

There is still room for improvement as noted previously in my comments on each of the watches.

Effort should be made not to assign workers with chronic health problems, that a physician determines probably would be adversely affected by a watch schedule, to a rotating work timetable.

Crew responsibility for maintaining good lifestyle and health practices should be emphasized and facilitated as much as possible by the WSF.

It may be worthwhile to re-survey the members of these crews in a year, using the same questionnaire tool, to determine how they perceive the changes.

I appreciate the opportunity to ~~review~~ and comment on the ~~changes~~ made in the Bremerton-Seattle shift ~~schedule, which from a health standpoint,~~ are definitely ~~steps in the right direction.~~

Sincerely,

P J Sparks MD

Patricia J. Sparks, M.D., M.P.H.
Consultant in Occupational Medicine

Enclosures

BREMERTON WORK SCHEDULES
Prior to October 18, 1987

(1) "A" Watch worked Monday through Friday from 5:00 PM to 1:55 AM with Saturday and Sunday off for first week. Second week Crew rotated to 6:15 AM to 1:20 PM watch for Monday through Friday with Saturday and Sunday off.

(2) "B" Watch worked the first week Wednesday through Friday from 5:30 AM to 12:35 PM and worked Saturday and Sunday from 6:15 AM to 1:20 PM, followed by Monday and Tuesday off. The second week the crew worked Wednesday through Sunday but rotated to 5:00 PM to 1:55 AM with Monday and Tuesday off.

(3) "C" Watch worked the first week Monday through Friday from 1;20 AM to 8:35 PM with Saturday and Sunday off. The second week the crew worked Monday through Friday but rotated to 12:15 AM to 9:00 AM with Saturday and Sunday off.

(4) "D" Watch worked Saturday through Wednesday (start at the end of the first week) from 1:20 PM to 8:35 PM with Thursday and Friday off. The second week the crew worked Saturday through Wednesday but rotated to 12:15 AM to 9:00 AM with Thursday and Friday off.

(5) "E" Watch worked Fridays 9:00 AM to 5:00 PM; and Saturday through Tuesday from 5:00 PM to 1:55 AM (end of first week) with Wednesday and Thursday off. The second week the crew worked Friday 9:00 AM to 5:00 PM; and Saturday through Tuesday rotated to 5:35 AM to 12:35 PM with Wednesday and Thursday off.

(6) "F" Watch worked Thursday through Sunday from 12:15 AM to 9:00 AM; and Monday from 9:00 AM to 5:00 PM with Tuesday and Wednesday off. The second week the crew worked Thursday through Sunday but rotated to 1:20 PM to 8:35 PM; and Monday 9:00 AM to 5:00 PM with Tuesday and Wednesday off.

AT:mlb

SUMMARY OF EXISTING
BREMERTON CREW SCHEDULES
(As of October 18, 1987)

(1) "A" Watch works a steady graveyard watch, no rotation, 10 days on (1:00 AM to 9:00 AM) followed by 4 days off (Monday through Thursday). All 8 hour watches.

(2) "B" Watch works a steady watch, no rotation, 10 days on (5:35 AM to 1:35 PM) followed by 4 days off (Monday through Thursday). All 8 hour watches.

(3) "C" Watch works on the #1 vessel Monday through Thursday from 1:00 AM to 9:00 AM, and Friday 9:00 AM to 5:00 PM with Saturday and Sunday off. Week #2 "C" Watch works Monday through Thursday 5:35 AM TO 1:35 PM and Friday 9:00 AM to 5:00 PM followed by Saturday and Sunday off.

(4) "D" Watch works ten days straight, Monday through Friday from 1:35 PM to 8:35 PM, and then rotates on Saturday through Wednesday to 5:00 PM to 2:00 AM followed by 4 days off; Thursday through Sunday.

(5) "E" Watch works ten straight days, Monday through Friday from 1:35 PM to 2:35 AM, and then rotates to Saturday through Wednesday from 5:00 PM to 2:00 AM, followed by four days off; Thursday through Sunday.

(6) "F" Watch works Thursday and Friday from 5;00 PM to 2:00 AM then works Saturday and Sunday from 1:35 PM to 8:35 PM and then works Monday from 9:00 AM to 5:00 PM. "F" Watch then has Tuesday and Wednesday off.

AT1:mlb

SUMMARY OF EXISTING
BREMERTON CREW SCHEDULES
(As of October 18, 1987)

(1) "A" Watch works a steady graveyard watch, no rotation, 10 days on (1:00 AM to 9:00 AM) followed by 4 days off (Monday through Thursday). All 8 hour watches.

(2) "B" Watch works a steady watch, no rotation, 10 days on (5:35 AM to 1:35 PM) followed by 4 days off (Monday through Thursday). All 8 hour watches.

(3) "C" Watch works on the #1 vessel Monday through Thursday from 1:00 AM to 9:00 AM, and Friday 9:00 AM to 5:00 PM with Saturday and Sunday off. Week #2 "C" Watch works Monday through Thursday 5:35 AM TO 1:35 PM and Friday 9:00 AM to 5:00 PM followed by Saturday and Sunday off.

(4) "D" Watch works ten days straight, Monday through Friday from 1:35 PM to 8:35 PM, and then rotates on Saturday through Wednesday to 5:00 PM to 2:00 AM followed by 4 days off; Thursday through Sunday.

(5) "E" Watch works ten straight days, Monday through Friday from 1:35 PM to 2:35 AM, and then rotates to Saturday through Wednesday from 5:00 PM to 2:00 AM, followed by four days off; Thursday through Sunday.

(6) "F" Watch works Thursday and Friday from 5;00 PM to 2:00 AM then works Saturday and Sunday from 1:35 PM to 8:35 PM and then works Monday from 9:00 AM to 5:00 PM. "F" Watch then has Tuesday and Wednesday off.

AT1:mlb

BREMERTON WORK SCHEDULES
Prior to October 18, 1967

(1) "A" Watch worked Monday through Friday from 5:00 PM to 1:55 AM with Saturday and Sunday off for first week. Second week Crew rotated to 6:15 AM to 1:20 PM watch for Monday through Friday with Saturday and Sunday off.

(2) "B" Watch worked the first week Wednesday through Friday from 5:30 AM to 12:35 PM and worked Saturday and Sunday from 6:15 AM to 1:20 PM, followed by Monday and Tuesday off. The second week the crew worked Wednesday through Sunday but rotated to 5:00 PM to 1:55 AM with Monday and Tuesday off.

(3) "C" Watch worked the first week Monday through Friday from 1;20 AM to 8:35 PM with Saturday and Sunday off. The second week the crew worked Monday through Friday but rotated to 12:15 AM to 9:00 AM with Saturday and Sunday off.

(4) "D" Watch worked Saturday through Wednesday (start at the end of the first week) from 1:20 PM to 8:35 PM with Thursday and Friday off. The second week the crew worked Saturday through Wednesday but rotated to 12:15 AM to 9:00 AM with Thursday and Friday off.

(5) "E" Watch worked Fridays 9:00 AM to 5:00 PM; and Saturday through Tuesday from 5:00 PM to 1:55 AM (end of first week) with Wednesday and Thursday off. The second week the crew worked Friday 9:00 AM to 5:00 PM; and Saturday through Tuesday rotated to 5:35 AM to 12:35 PM with Wednesday and Thursday off.

(6) "F" Watch worked Thursday through Sunday from 12:15 AM to 9:00 AM; and Monday from 9:00 AM to 5:00 PM with Tuesday and Wednesday off. The second week the crew worked Thursday through Sunday but rotated to 1:20 PM to 8:35 PM; and Monday 9:00 AM to 5:00 PM with Tuesday and Wednesday off.

AT:mlb

HEALTH EFFECTS OF SHIFTWORK IN MARINE TRANSPORTATION

Patricia J. Sparks, M.D., M.P.H.
[redacted]

I. BACKGROUND

1. In 1982 the shift schedules changed due to demands from the ridership
2. RUN A - (Bremerton run) work shfits changed 3 times in an 8-day period with starting times as early as 5:00 AM and finish times as late as 2:00 AM
3. Other runs had less extreme changes but still had some watches that were undesirable because of the hours of work
4. **Study background**
   b. 1984, Dr. Pasquale had the deck crews on the Bremerton run keep sleep diaries for a week - patterns abnormal
   c. In 1986, the DOT and MM&Ps contracted with me to perform a literature review and survey of the health effects of shift work among the MM&Ps.

II. LITERATURE REVIEW

1. **Disruption of circadian rhythms, social & personal habits**
   a. Jet lag (acute)
   b. Shiftwork (chronic)
2. **General statements**
   a. Greater sick leave
   b. Poorer scores on a variety of health indices
   c. Self-selected group
   d. Dropouts are sicker

III. MATERIALS AND METHODS

1. **Population:**
   a. 121 members of the International Organization of Masters, Mates & Pilots of the Washington State Ferries
   b. Larson slide, macho, set example, self-selected
   c. 93, or 77%, responded to the questionnaire
2. **Survey questionnaire**
   a. NIOSH (Smith, Colligan & Tasto)
   b. Pretested
   c. Administered to over 2000 shiftworkers nationwide.
3. **250 questions on:**
   a. Background

b. Personal habits
c. Lifestyle
d. Job
e. Health
f. Psychological state
g. Sleep patterns
h. Eating patterns
i. Shift schedule

4. **Performance questions on:**
   a. Falling asleep at work
   b. Errors of judgement
   c. Near misses
   d. Falling asleep at wheel (auto)
   e. Auto accidents
5. **Days lost from work:**
   a. Sick days
   b. Work-related injury or illness
6. **Data Analysis**
   a. Computerized data base
   b. Reflex for the Mac
   c. Statview (ANOVA, T-test, Chi-square)
7. **Comparison Groups**
   a. Literature re: other occupational groups
   b. Bremerton versus other runs of the ferry system
8. **Problems with Outside Occupational Comparison Group**
   a. Age
   b. Health
   c. Demographics
   d. Substance abuse

IV. <u>RESULTS</u>

1. **High response** comparied with other surveys (77%). Respondees might be different
2. **Demographics**
   a. Bremerton run did not differ significantly from the group as a whole
   b. Average age 44, worked for ferries 16 years, on current watch 3 years. Only 4% are women.
3. **Nurses on rotating shifts**
   a. Increased clinic visits
   b. Increased sick days

4. **Illness among shiftworkers**
   a. Increased GI disturbances
   b. Increased psychoneurotic disorders
   c. Increased risk factors for cardiovascular disease
5. **General Health**
   a. The use of aspirin and anti-acids in the group as a whole is somewhat higher than that observed in other shiftworkers studied by Tepas.
   b. The prevalence of those who have been told by a physician that they have hypertension is somewhat higher than would be expected for a group of average age 44, mostly caucasian males (22% vs. 10%)
   c. The average number of sick days (13) was significantly higher among those on the Bremerton run.
   d. Sick day difference not likely to be due to significant differences in age, sex, reports of poor health, hypertension, heart disease, respiratory and other healtn problems.(or to alcohol or cigarette use as we will see later).
      This suggests that differences in sick days may not be related to poor general health and **perhaps** fatigue is a factor.
6. **Physical and Psychosocial complaints among shiftworkers**
   a. Increased injury rate and more severe injuries
   b. Increased substance abuse
7. **Substance Misuse or Abuse**
   a. **26%** of whole group reports that they drink 4 or more ounces of alcohol at a time when they do drink (which seems high); **48%** drink alcohol on work days but **none** reported drinking **on the job**. **8%** use alcohol to get to sleep. A more detailed study of alcohol consumption would be useful.
   b. There were no significant differences in reported alcohol use in workers on the Bremerton run.
   c. 27% of the group smokes and this is comparable to other groups of males of this groups average age
   d. Self reports of medication use is comparable to other shiftworkers studied by Tepas which was not significantly higher than among non shiftworkers.
8. **Shiftwork and job satisfaction**
   a. Decreased satisfaction in general
   b. Many factors affect job satisfaction besides shiftwork
   c. Sequence and frequency of shift changes affects job satisfaction

9. **Psychosocial Adjustment**
   a. **At least half** of the shiftworkers and their families are dissatisfied with their schedules and believe their schedules interfere with their sex lives.
   b. Significantly more workers on the Bremerton run are dissatisfied with their schedule.
   c. **About 1/3** felt that the shift schedules interfered with time for family, children, outside groups and hobbies.
   d. The above responses are comparable to other studies of the impact of rotating and night shift work on social and personal well-being.
   e. The divorce prevalence of **19%** is comparable to other night shift workers of similar age, but higher than the general population of similar age.
   f. The great majority of shift workers like their work, their co-workers, and consier themselves good workers. This is much higher than in other studies of shift workers.

1. **Sleep Patterns**
   a. The mean number of hours of sleep per day is **6.** almost 2 hours less than the stated ideal and lower than that of day workers in other studies.
   b. The proportion of those feeling tired at work at least 2-3 days per week is **higher** than night shift workers studied by NIOSH with the same questionnaire.
   c. Poor sleep pattern may be reflective of psychological mood disorders, environmental factors, or disturbances of circadian rhythm.
   d. Significantly more MM&Ps on the Bremerton run report difficulty going back to sleep once they wake up, that their sleep pattern in general is poor & that they feel tired at work 2-3 times per week or more.
   e. **36%** of the MM&Ps on the Bremerton run had consulted a physician for insomnia vs. **7%** of the other MM&Ps.
   f. More sleep difficulties suggested on the Bremerton run

3. **Eating Patterns**
   a. There are no significant differences between the groups in terms of number of meals per day, appetitie, snacking, number of meals with family or friends or dissatisfaction with eating pattern.
   b. Clearly, though, the shift schedules interfere with the social interaction that sharing meals meals with friends and family

affords.

4. **Performance at night**
   a. At night, the decrease in mental work is greater than the decrease in physical work
   b. Decreased vigilance is observed with perceptual isolation or monotonous surroundings
   c. Decreased performance in airline pilots at night

   a. Decreased performance on night shift with dip at 3-4 a.m.
   b. Telephone operators
   c. Meter readers
   d. Train engineers
   e. Truck drivers
5. **Incidents/Performance**
   a. In the group as a whole, **7%** have been involved in ferry **accidents**, **2%** where fatigue was a factor.
   b. **33%** have had **near misses** in their current watch, **20%** where **fatigue** was a factor.
   c. **23%** report **errors of judgement**, **20%** where **fatigue** was a factor.
   d. **43%** reported **falling asleep at work** on their current watch, **23%** as **often** as once per month.
   e. Questionnaire did not differentiate falling asleep at the wheel or in their cabin.
   f. **7%** have had **auto accidents** due to falling asleep, **42% near misses** due to sleepiness.
   g. A significantly greater proportion of MM&Ps on the Bremerton run report **errors of judgement**, especially where **fatigue** was a factor.
   h. Significantly more on the Bremerton run report **near misses** related to **fatigue**.
   i. A greater proportion on the Bremerton run report having had **ferry accidents related to fatigue** but results are not significant perhaps due to the small numbers of accidents.
   j. The above reports suggest that fatigue due to shiftwork may well be a factor resulting in **potentially serious errors** of judgement and probably **increasing the risk of ferry accidents.**

Re: Chronic Fatigue Relating to Safe Operation
of Washington State Ferry Vessels

Dear Committee:

My 14 years with Washington State Ferries' (WSF) work scheduling has resulted in the following personal conclusions:

I.

The lack of continuity in my work hours has resulted in:

A. Interrupted work patterns
B. Interrupted sleep patterns
C. Interrupted family/social patterns
D. Detriment to Health

A. Interrupted Work Patterns

My work schedules have had no regularity from day to day or week to week. For example, our so-called improved schedule consists of two 5:00 p.m. - 2:00 a.m. work periods followed by two 1:35 p.m. - 8:35 p.m. work periods followed by one 9:00 a.m. - 5:00 p.m., after which we have two days off.

The direct result of such a schedule is impaired judgement, slowed response time, drowsiness at inappropriate times, excessive nervousness due to increased caffeine intake, and irritability. During this time, we have as many as 2,000-plus passengers on board.

How long would management put up with these working conditions? Prototypes of work schedules without these gyrations have been developed.

B. Interrupted Sleep Patterns

I do not get quality sleep throughout the five-day work period. The first two days, I must sleep from 3:30 a.m. - 11:00 a.m., immediately following the normal waking and sleeping hours of my two days off. Therefore, I awake automatically at 7:00 a.m. but remain in bed and attempt to get as good a sleep as possible between 7:00 a.m. and 11:00 a.m. (Does one ever lock out those normal rush hour, lawn mower, people sounds that go on as the world charges into a new day?)

Next, just as I've adjusted to day-time sleep or need it so badly I pass out into sleep, I must sleep nights. Finally, by the fifth day, which is a very normal 9:00 a.m. - 5:00 p.m. shift and should be the easiest, I find it difficult due to both an earlier wake-up time and a general malaise from a week of bounce-time sleep.

This type of sleep requires planning ahead and no little concentration. I must attempt to synchronize my mind and body as they seem to disagree over which is in charge of being tired.

My dentist has told me that my intense effort to sleep has caused me to grind my teeth badly. It comes from working at sleeping.

C. Interrupted Family/Social Patterns

My family life has undergone considerable stress due to the irregular hours I work and the ensuing affect on me both mentally and physically.

When I started working for WSF, at the age of 30, my daughter was 10. It was very hard for her to not see me for days at a time. She did not understand nor, at the time, did I know the full ramifications of the lack of quality time I could give her.

Although my marriage remains strong, it is also subjected to severe stresses. Mine is not the only marriage so affected. I have observed divorces, affairs, and less drastic but no less severe strains and stresses among my co-workers. These situations are always abetted by these irregular hours and conditions.

Further, the fuller social life we all aspire toward, I have sacrificed in order to function at a high level of competence in my profession. Instead of political campaigning, environmental action, and community volunteer work, my focus has been on time. I need to regenerate my energy for work. The irregularity of the hours precludes attending anything scheduled at regular intervals.

As for a normal social life --- what's that? Most WSF workers are on the job every holiday and weekend when friends and family enjoy their time off. Although we see thousands of people each working day, we have little social contact with them. Coupled with the lack of social opportunities off the job, one might consider antisocial attitudes an occupational hazard.

D. Detriment to Health

I attribute several conditions of ill health that I've experienced to the irregular working hours and shifts throughout my WSF career.

I have had one car accident, on the way home from a graveyard shift, directly attributable to my inability to react quickly. Others have told me they believe this to be the case in their various mishaps also.

However, the real cost of chronic fatigue may be the shortening of the individual's life span, although this will only come to light after more sophisticated and long-term studies.

II.

Because I have been invited to write and speak on the personal aspects of chronic fatigue, I will share with you some potentially positive solutions my colleagues and I have discussed for many years:

A. Rotation of work schedules on a monthly basis.

B. No priority of work schedule assigned according to seniority.

C. Assign crews to single vessels as The Marine Employee Benevolent Association (MEBA) does.

D. Locate tie-up of vessels in more equitable locations.

A. Rotation of work schedules on a monthly basis

Harvard researchers who studied a mining company in Utah found a two-part solution that benefited both workers and the company.

1. They rotated the shifts with a frequency of 28 days or longer.

2. They rotated the shifts forward in time which greatly reduced the stress caused by the change.

B. No priority of work schedule assigned according to seniority

If all crews were treated equally, regardless of seniority, the rotational schedule would allow everyone to be more productive, more alert, and less stressed. All of these benefits occurred in Utah after the mining company implemented the Harvard recommendations.

When a crew benefits, at the expense of all others, the whole system loses.

C. Assign crews to single vessel as MEBA does.

MEBA has found that assignment to one vessel has helped instill pride toward it, and therefore the performance of each individual vessel is enhanced. I suggest this would also hold true for deck-crew accountability of each vessel.

D. Locate tie-up of vessels in more equitable locations.

Tying up the vessel in equally distributed locations, instead of all vessels for a particular run on one side of the Sound, would provide better service for WSF customers. This would also eliminate deadheading for crew members who do not live on the islands or peninsulas. Also, it would lessen the sleep disturbances of those who must sleep aboard the vessels the night before in order to start work on the layover side.

SUMMARY

The fact that chronic fatigue exists among ferry boat workers has ample documentation. It may not always be the primary factor in those incidents in which accidents occur, but it is, in my opinion, at the very least a contributing factor.

As Dr. E. Wenke states, "Seventy-five percent of all accidents are attributable to human error." The probability of an accident occurring when the human involved is not at optimum alertness, caused by a high fatigue factor, rises proportionately.

DO WE NEED A MAJOR ACCIDENT BEFORE THIS PROBLEM IS ADDRESSED?

Respectfully,

Captain Lynda Wheeler

Captain Lynda Wheeler

SWING RELIEF
DECK SCHEDULE

ROUTE: WINSLOW, ANACORTES, VASHON
RELIEF: WINSLOW, ANACORTES, VASHON
HOME PORT: WINSLOW

VESSEL:

WINSLOW
KITTITAS
QUINAULT

Effective June 19, 1988:

		AM	PM
Week (1)	SUN		1600-2320 VASHON (QUINAULT)
	MON	OFF	
	TUE	OFF	
	WED		1540-2240 ANACORTES (KITTITAS) (1505-2205 6/19-7/2)
	THURS	0640-1540 ANACORTES (KITTITAS) (0605-1505 6/19-7/2)	
	FRI		1900-0300 WINSLOW
	SAT		2230-0710 WINSLOW

		AM	PM
Week (2)	SUN		1600 - 2320 VASHON (QUINAULT)
	MON	OFF	
	TUE	OFF	
	WED		1540-2240 ANACORTES (KITTITAS) (0605-1505 6/19-7/2)
	THURS	0640-1540 ANACORTES (KITTITAS) (0605-1505 6/19-7/2)	
	FRI		1900-0300 WINSLOW
	SAT		2230-0710 WINSLOW

DAYS OFF: MON/TUE

DS1:mlb
May 27, 1988

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON
MERCHANT MARINE AND FISHERIES
May 31, 1988
STATEMENT

LIFE RAFTS

I am honored and grateful to contribute my experience and perceptions to this Congressional committee.

I first went to sea in 1943 with the U.S. Navy. After several Pacific invasions, I was honorably discharged and entered the Maritime industry where I earned a First License (N.Y. Harbor Pilot) in 1948.

I have served since, mostly as Master on the waters of N.Y. Harbor, the Great Lakes, most of the major harbors of the East Coast, the Mississippi River, Hawaiian Islands, Columbia River and Puget Sound.

For four (4) years I served as Safety Coordinator for the Deck Officers of Washington State Ferries.

I am presently Master of the super-ferry "Yakima".

The rules for Life Rafts for ferries are separate from the rules that apply to other passenger vessels (Title 46-CFR, Table 75.10-10 [B] [1]). These rules stop at 600 tons--period. These rules incredibly require life rafting for 36 persons total even though our vessels carry up to 2500 persons.

The rules were written more than forty (40) years ago. There have been numerous and dramatic changes in Puget Sound in that time as follows:

1. Forty years ago, our ferries were 1/3 the size--they were slower and they carried 1/10 the passengers they carry today.

2. The waters of Puget Sound are more congested by far than forty years ago.

LIFE RAFTS (Continued):

The average ship then was 5 to 8 thousand ton and did 8 to 13 knots.

We encounter today ships of 30 to 50 thousand tons, doing in excess of 22 knots and most have a ramlike bulbous bow which increases the chances of hull penetration.

1. The mix of cargo in autos, trucks and R.V.'s is in most cases uninspected and unknown--there is every reason to believe that we carry now many times the hazardous chemicals and inflammables than forty years ago.

2. And most important, forty years ago our knowledge of the effects of hypothermia was limited.

Today we have medical proof that persons in the cold (47°) waters of Puget Sound for 15 to 30 minutes may not be able to help themselves--meaning they cannot grab a line or a ladder or get themselves up and into a boat or raft. It is imperative that these persons be kept out of the water or they shall begin to die.

So the risk of collision is greater today and the impact and result of such a collision would be more profound.

The risk of fire is greater and the means to control that fire is questionable.

If an unbiased expert could guarantee that ferries cannot sink--we would not be here OR if an unbiased expert could guarantee that if a ferry sank, capsized or was engulfed in flames that enough meaningful help would arrive to remove all passengers from the water in 15 to 30 minutes--we would not be here today.

For many and valid reasons, the United States Coast Guard. requires that we (the ferry crew) be ready at all times to abandon ship.

LIFE RAFTS (Continued):

If this very day the 5:25 p.m. ferry to Winslow were to abandon ship in the middle of Puget Sound, hundreds would die needlessly, for lack of Life Rafts and timely help.

It is morally indefensible to deny any ferry passenger the chance to survive such an event.

I therefore recommend:

1. Life Raft capacity for all passengers and crew.

2. A means to place these passengers into the Rafts--quickly and safely.

Robert T. Davis

Captain Robert T. Davis
"M.V. Yakima"

FATHOMETERS

All vessels over 1600 tons navigating on the inland waters of the Untied States are required by law (33 CFR 164) to be equipped with Fathometers.

Ferries of comparable size on all the other ferry systems in the United States are equipped with Fathometers--these systems operate on only one route.

Washington State Ferries operate on 8 routes from more than 1 mile to over 30 miles in length in an area extending North and South for 90 miles.

It is a regular practice in our system to move vessels and crews from one route to another.

FATHOMETERS (Continued):

British Columbia Ferries operating in like conditions and having many double-ended vessels with the same propeller and hull configurations are all equipped with Fathometers.

Our two major navigation tools are the compass and the radar. As important as these are, they cannot tell us the actual depth of the water.

We assume what the depth is. We also are to assume that the bottom never shifts and that our memories of the depths foot by foot over 90 miles is perfect.

This is a dangerous assumption.

Fathometers have prevented hundreds of ships from grounding.

In my opinion, at least two (2) recent groundings in our system could have been prevented if those vessels had been Fathometer equipped with a pre-set depth alarm ("Wallawalla"-April 1981 and "Issaquah"-December 1983).

The United States Coast Guard has exempted all Washington State Ferries from this rule.

They have denied Fathometers without consulting with our Deck Officers who legally bare the total responsibility for the safe navigation of our vessels.

I therefore recommend:

1. That the exemption be removed.

2. I ask also that before any exemptions be granted in the future for vital navigation equipment that the Captains of the vessels be consulted.

Robert T. Davis

Captain Robert T. Davis
"M.V. Yakima"

STATEMENT OF CAPT. GARY FREDBACK

Good afternoon ladies and gentlemen, distinguished guests.

First of all, I'd like to thank everyone for their attendance here today and a special thanks to Congressman Lowry and his associates for their efforts in bringing this hearing together to shed light on the hazards associated with rotating shifts and other safety issues. I must confess I'm used to being a public figure but I'm not used to public speaking so please bear with me.

As we all know , in the field of public transportation, safety is priority number one. This priority is in jeopardy, at present, with a number of temporary working schedules that were implemented almost six years ago in a cost cutting move by the management of W.S.F. From the onset of these schedules, masters and mates of W.S.F. have warned management of the dangers associated with rotating shifts in conjunction with circadian desynchronosis and/or performance degradation. With the number of studies now available on this subject, I never dreamt that it would take an act of congress to hear our concerns on this matter but we felt it necessary in that we weren't being heard by our supervisors.

In your information folders, I've included copies of title pages on the studies of aircraft pilot fatigue, conducted by NASA, also one on hearings about biological clocks and shift work scheduling. I did not include the complete study as they pretty much paralleled the inquiry by Dr. Sparks on masters and mates of W.S.F. and were very detailed. I've read recently that the

F.A.A. wants to do another, even more in depth study, on the subject of sleep loss, and the effects of, as they feel even more time may be needed for recuperation after suffering from circadian desynchronization.

With the high degree of responsibility, inherent in the position of master or mate on passenger carrying vessels, it is vital that public trust be intrinsic. The last and most important link in the chain of navigating a ferry safely from point A to point B lay in the hands of the pilot. All of the behind the scene activities that take place at the D.O.T in our state capital and at pier 52 holds little bearing on the decisions that are required in the command of a vessel. The principal issue that management should be addressing here is the health and welfare of our vessels pilots, for know matter how well that vessel is attended too from shore side personnel, it's no safer than the mental and physical well being of it's pilot.

In the past, vessel traffic, speed and tonnage on Puget Sound was considerably less. The same holds true of yesterdays ferries. In modern times these same waters have become and will continue to become more congested just as the ridership of our ferries will. Last year W.S.F. carried a record 18.5 million passengers while still operating under the Code of Federal Regulations Title 46 established at a time when mental fatigue was not considered a safety factor for sailors and thus not studied. These regulations were established for generalities of open sea sailing and did not specify or differentiate between

those who sail more congested waters. In ocean sailing, rarely does one see other vessels, close hand, and consequently aren't faced with the stresses and decisions of collision at sea. On a ferry, masters and mates are faced with judgments of that nature nearly every trip since our courses run perpendicular to the shipping lanes. These decisions can not and must not continue to be hindered by mental fatigue.

I have the privilege of not only holding a pilots license as a merchant marine officer, I'm also licensed in the field of aviation. This has given me the opportunity to gather information from a number of professional airline pilots and get the latest in material on the subject of pilot fatigue do to sleep loss. One of the topics of distinction is that of "deadheading," that time spent traveling to and from the job via plane or vessel. In the airlines the policy on rest is known as "behind the door rest". It states that 15 minutes after an airline pilot is relieved from duty he is to have a minimum of 9 hours rest without interruption. This rest period can be extended if a pilot is further stressed by more than 7 cycles (take off and landings) in a shift, or if in instrument conditions for certain time frames. There are a number of other stipulations on stress factors and rest periods that become far too time consuming to go into at present. What is being said here in short is, that airlines must recognize the human factor by F.A.A. regulations as a safety factor and deal with it as such.

In contrast, the masters and mates of W.S.F. have a minimum of 6 hours off between watches. Up to 3 hours of that time may be spent in deadheading which does not include time spent going to and from home. No extra time off is alloted for working in high stress conditions ie. high winds and weather tides, low or no visibility due to fog or snow in which as many as 25 cycles may occur in an 8 hour period.

I'm not saying that piloting a ferry is as complex or demanding as flying a 747. What I am stating is that in consideration of safety, ferrying up to 2,500 passengers in conditions that, at times, even airlines won't venture in too has it's own set of stresses that are greatly compounded by a lack of proper rest and respect of the human factor.

With the amount of money being spent by ferry management on equipment which, for the most part, is either unnecessary or proves to be another failed experiment, I feel that capital should be employed toward the restructuring of work schedules for the most important safety equipment on board: The health, welfare and morale of our pilots.

Thank you

Capt Gary Friedrichs

QUESTIONS FOR THE RECORD
TO CAPTAIN GARY FREDBACK
FROM MIKE LOWRY (D-WA)

BASED ON YOUR EXPERIENCE, DO YOU BELIEVE WORK HOURS ON THE WASHINGTON STATE FERRIES RESULT IN CREW FATIGUE? PLEASE GIVE SPECIFIC EXAMPLES.

HAVE YOU EVER WITNESSED A CREWMEMBER FAILING TO PERFORM OR PERFORMING IN AN UNSAFE MANNER HIS OR HER DUTIES ON BOARD THE FERRIES AS THE RESULT OF FATIGUE?

DOES CREW FATIGUE POSE A PROBLEM ON ALL VESSEL ROUTES OR JUST SOME?

WHICH VESSEL ROUTES ARE THE MOST PROBLEMATIC?

IN YOUR OPINION WHAT CHANGES NEED TO BE MADE TO CORRECT THE SCHEDULING PROBLEMS?

AS I UNDERSTAND, THE CURRENT LABOR AGREEMENT BETWEEN THE WASHINGTON STATE FERRIES AND THE MASTER MATES, AND PILOT'S UNION REQUIRES THAT A COMMITTEE CONSISTING OF VESSEL OFFICERS AND WSF MANAGEMENT BE CONVENED TO ADDRESS THE OUTSTANDING PROBLEMS REGARDING CREW FATIGUE AND SCHEDULING.

HAS THIS COMMITTEE BEEN FORMED?

WHO ARE THE COMMITTEE MEMBERS?

IF POSSIBLE, I WOULD LIKE TO BE KEPT APPRISED OF THE PROGRESS OF THIS COMMITTEE.

Captain Gary Fredback
945 N.W. 57th
Seattle, Wa. 98107-2848
9-26-88

U.S. House of Representatives
Committee on
Merchant Marine and Fisheries
Room 1334
Longworth House Office Building
Washington, DC 20515-6230

Dear Chairman Hutto,

First, Mr. Chairman, I'd like thank you and Congressman Lowry for this opportunity to do a follow-up questionnaire on the hazards associated with crew fatigue and rotating shifts. As you are both well aware the subject of circadian desynchronosis has been studied for a number of years now and the evidence clearly reveals just how dangerous this type of work scheduling can be.

In answer to some of your questions I've enclosed a copy of an article printed in August of last year. I want to reiterate this point as this particular watch still exists. Ferry management has stated that the problems with work hours have been "taken care of" with the rescheduling of the Seattle/Bremerton (S/B) crews. As you can see by the article the problems are far reaching and that the S/B run is used only as an example. In addition, (and this gets a little complicated) the rescheduling of the S/B crews has created further problems on the Seattle/Winslow (S/W) run as crews ending at midnight must now wait until 2:30 am before being returned to Seattle.

Getting back to your specific questions, yes, I firmly believe work hours on Washington State Ferries (WSF) create a great deal of mental and physical fatigue. I differentiate the two as I find it more difficult, as an officer, to deal with mental fatigue than with physical lassitude.

Everyone has dozed off when they're supposed to be awake. I'm sure Mr. Chairman you've experienced lapses perhaps while watching television or at a friends home viewing vacation slides. As a consequence, you may end up missing the end of a movie or, at worst, suffer a little embarrassment. Imagine feeling the same way in command of a vessel with passengers on board while traversing busy shipping lanes. The consequences here could surly prove more than a little embarrassing.

Sick leave is up, divorce rate is up, injury accidents are climbing as well as near misses. Crew apathy is soaring and morale has struck bottom. All of this results in a poor attitude toward the job and consequently substandard public relations.

I've witnessed, on numerous occasions, crew members failing in their duties due to fatigue. I myself would not be quite so involved with this subject if not for the fact that I too have made a number of fatigue related mistakes while on watch. Things as simple as wrong rudder commands or as consequential as forgetting to engage a propeller when making a landing. I call this sort of behavior "sleep walking". There's a fine line

between consciousness and unconsciousness even with eyes wide open in a fatigued mental state.

A study conducted by NASA, March 31, 1981, Fatigue and Associated Performance Decrements in Air Transport Operations, clearly shows how serious airline pilots and the Federal Aviation Administration (FAA) consider this subject. They have a system where by pilots make a written report any time they feel there is a problem having to do with fatigue. This to me shows true professionalism which, in turn, leaves me wondering why our requests on this matter have been, until recently, ignored by management of WSF. If not for the congressional involvement here I rather doubt they would be giving this issue any consideration presently.

In response as to whether crew fatigue poses a problem on some or all routes and to which routes are most problematic, my comment would be that each run is different. By this I mean that they have their own set of schedules (running and working) and their own degree of stress.

Again, using Fauntleroy as an example, certain watches are required to sleep on board. They tie up at 8:30 PM at a dock where other ferries come and go until 2:30 AM making it next to impossible to sleep. Then they're scheduled to be back on the job at 4:30 AM. Crews working out of Seattle's Pier 52 have a great deal of traffic (commuter passengers, vehicles, shipping) to contend with along with stressful hours. The Edmonds run has some crews trying to sleep on a working vessel. The international ferry has crews working a 6 hour day ending at 11:00 PM followed by a 10 hour day after just 6 hours off. The Port Townsend run has a very narrow harbor to navigate along with a great deal of fog and high seas.

As to what changes are needed I can only say that I am neither a dispatcher nor schedule-minded person. My conjecture on the subject would be to offer suggestions to the fleet on adjusting our working hours to fit those of the findings from the Dr. Sparks study, or, perhaps look into 12 hour days (7-on 7-off), rotating shifts, or use some innovation and tie vessels on both sides of the sound to cut down on the amount of time spent dead-heading.

A committee, consisting of Capt. Tom Jacobs and myself, representing the Masters, Mates and Pilots (MM&P), Mr. Dave Black and Mr. Armond Tiberio, representing the management of WSF, held a meeting on July 25th, 1988, to discuss the problems surrounding the present work schedules. It was agreed by all parties that a questionnaire on the various options of work hours, noted in the aforementioned paragraph, be drafted by myself and Capt. Jacobs to be distributed to all MM&P throughout WSF with the idea of getting some positive feedback.

I will keep you apprised of our progress over the next few months and give you an update on what is accomplished at our next meeting.

Sincerely,

Capt. Gary Fredback

Capt. Gary Fredback

ONE HUNDREDTH CONGRESS

WALTER B. JONES, NORTH CAROLINA, CHAIRMAN

MARIO BIAGGI, NEW YORK
GLENN M. ANDERSON, CALIFORNIA
GERRY E. STUDDS, MASSACHUSETTS
CARROLL HUBBARD, JR., KENTUCKY
DON BONKER, WASHINGTON
WILLIAM J. HUGHES, NEW JERSEY
MIKE LOWRY, WASHINGTON
EARL HUTTO, FLORIDA
W. J. (BILLY) TAUZIN, LOUISIANA
THOMAS M. FOGLIETTA, PENNSYLVANIA
DENNIS M. HERTEL, MICHIGAN
ROY DYSON, MARYLAND
WILLIAM O. LIPINSKI, ILLINOIS
ROBERT A. BORSKI, PENNSYLVANIA
THOMAS R. CARPER, DELAWARE
DOUGLAS H. BOSCO, CALIFORNIA
ROBIN TALLON, SOUTH CAROLINA
SOLOMON P. ORTIZ, TEXAS
CHARLES E. BENNETT, FLORIDA
THOMAS J. MANTON, NEW YORK
OWEN B. PICKETT, VIRGINIA
JOSEPH E. BRENNAN, MAINE
GEORGE J. HOCHBRUECKNER, NEW YORK
BOB CLEMENT, TENNESSEE

ROBERT W. DAVIS, MICHIGAN
DON YOUNG, ALASKA
NORMAN F. LENT, NEW YORK
NORMAN D. SHUMWAY, CALIFORNIA
JACK FIELDS, TEXAS
CLAUDINE SCHNEIDER, RHODE ISLAND
HERBERT H. BATEMAN, VIRGINIA
JIM SAXTON, NEW JERSEY
JOHN R. MILLER, WASHINGTON
HELEN DELICH BENTLEY, MARYLAND
HOWARD COBLE, NORTH CAROLINA
MAC SWEENEY, TEXAS
CURT WELDON, PENNSYLVANIA
PATRICIA SAIKI, HAWAII
WALLY HERGER, CALIFORNIA
JIM BUNNING, KENTUCKY
ERNEST L. KONNYU, CALIFORNIA

CHIEF COUNSEL
EDMUND B. WELCH

CHIEF CLERK
BARBARA L. CAVAS

MINORITY STAFF DIRECTOR
GEORGE D. PENCE

MINORITY CHIEF COUNSEL
DUNCAN C. SMITH III

U.S. House of Representatives
Committee on
Merchant Marine and Fisheries
Room 1334, Longworth House Office Building
Washington, DC 20515-6230

July 7, 1988

Admiral Harold W. Parker
Assistant Secretary of Transportation
Marine Division, Washington State Ferries
Pier 52, Coleman Dock
Seattle, WA 98104

Dear Admiral Parker:

As you are avare, the Subcommittee on Coast Guard and Navigation recently held a hearing on ferry vessel safety on Puget Sound.

Enclosed are follov up questions to the hearing. We vould appreciate a timely response to these questions so that they can be included in the official hearing record.

Thank you for your cooperation.

Sincerely,

Earl Hutto

Earl Hutto, Chairman
Subcommittee on Coast Guard
and Navigation

QUESTIONS FOR THE RECORD
TO THE WASHINGTON STATE FERRIES
FROM MIKE LOWRY (D-WA)

LIFESAVING

AS I UNDERSTAND, THE WASHINGTON STATE FERRIES RECENTLY PURCHASED SEVERAL INFLATABLE BUOYANT APPARATUSES WHICH WILL CARRY ABOUT 45 PASSENGERS. WHAT PROMPTED YOU TO PURCHASE THESE AND HOW HAVE THEY WORKED?

CREW FATIGUE: WASHINGTON STATE FERRY VESSELS

IN ITS INVESTIGATION, THE COAST GUARD DID NOT FIND THE SAFE NAVIGATION OF THE VESSELS TO BE IN JEOPARDY AS A RESULT OF THE CREW FATIGUE. HOWEVER, THE COAST GUARD DID STATE THAT THE CURRENT WORK SCHEDULES COULD RESULT IN SOME DEGREE OF FATIGUE. I AM CONCERNED THAT CHRONIC CREW FATIGUE HAS THE POTENTIAL TO REDUCE THE EFFECTIVENESS OF THE VESSEL OFFICERS.

FROM A MEDICAL STANDPOINT, IS SIX HOURS OFF BETWEEN SHIFTS AN ADEQUATE AMOUNT OF TIME FOR REST AND RECOVERY FOR THE CREW MEMBERS?

IS FOUR HOURS OFF ADEQUATE?

ONE OF THE MEDICAL CONCERNS RAISED BY THE CREWMEMBERS INVOLVES THE RAPID ROTATION OF WORK SCHEDULE. MEDICAL LITERATURE SEEMS TO INDICATE THAT IF SHIFTS ARE TO BE ROTATED THEY SHOULD BE ROTATED NO MORE FREQUENTLY THAN EVERY THREE WEEKS.

HAVE YOU EXAMINED THE CURRENT WORK SCHEDULES TO DETERMINE IF CHANGES CAN BE MADE WHICH WOULD RESULT IN ROTATING SHIFTS GENERALLY BEING MORE CONSISTENT WITH UP TO DATE MEDICAL RECOMMENDATIONS?

WHAT DID YOU CONCLUDE ABOUT THESE SHIFTS?

AS I UNDERSTAND THE SPARKS STUDY EXAMINED THE WORK SHIFT PROBLEMS ON THE BREMERTON RUN ONLY. IS WSF PLANNING A FOLLOW UP STUDY TO THE SPARKS SURVEY?

WAS THIS A RECOMMENDATION OF DR. SPARKS?

DOES THE FERRY SYSTEM HAVE ANY PLANS TO STUDY OTHER VESSEL RUNS TO DETERMINE THE EXTENT OF CREW FATIGUE?

THE CURRENT LABOR AGREEMENT BETWEEN THE WASHINGTON STATE FERRIES AND THE MASTER MATES, AND PILOT'S UNION PROVIDES FOR A SPECIAL COMMITTEE COMPRISED OF OFFICERS AND FERRY SYSTEM PERSONNEL TO ADDRESS SCHEDULING PROBLEMS. I WOULD LIKE TO KEPT APPRISED OF THE PROGRESS OF THE COMMITTEE.

HAVE THE COMMITTEE MEMBERS BEEN NAMED? IF SO, WHO ARE THE COMMITTEE MEMBERS?

WHEN IS THE COMMITTEE SCHEDULED TO MEET?

ARE MEDICAL EXPERTS BEING CONSULTED BY THE COMMITTEE TO INSURE THAT SHIFTS REDUCE CREW FATIGUE AND MAXIMIZE WORKER POTENTIAL?

CURRENTLY WHAT GUIDELINES DOES WSF FOLLOW WHILE DEVELOPING CREW SCHEDULES? DO THESE GUIDELINES INCLUDE SCHEDULING METHODS TO MINIMIZE CREW FATIGUE?

HAS THE WASHINGTON STATE FERRY SYSTEM CONSIDERED HIRING AN OUTSIDE CONSULTANT TO HELP DEVELOP WORK SCHEDULES WHICH MEET THE NEEDS OF THE RIDERS AND THE FERRY SYSTEM MANAGEMENT WHILE ALSO PROVIDING FOR HEALTHFUL WORK HOURS FOR THE VESSEL EMPLOYEES?

U.S. Department of Transportation
United States Coast Guard

Commandant
United States Coast Guard

Washington, D.C. 20593-0001
Staff Symbol: G-CC/104
Phone: (202) 366-4280

5730

MAY 9 1988

The Honorable Earl Hutto
Chairman, Subcommittee on Coast Guard
and Navigation
Committee on Merchant Marine
and Fisheries
House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

This is a follow-up to my letter of March 8, 1988, concerning the operation of the Washington State Ferries.

As requested in your letter of February 5, 1988, the Coast Guard conducted an inquiry into the incidence of fatigue among Washington State Ferry personnel and its impact upon the safe operation of these vessels. Due to the time constraints imposed, the inquiry was limited to a review of a number of scientific studies related to shift work and its effects on workers, interviews with both Washington State Ferry management personnel and with ferry employees affected by the schedules, and a review of the available Washington State Ferry casualty reports involving damage to property. Prior to conducting any of the interviews, contact was made with the leadership of the local office of the International Organization of Masters, Mates, and Pilots (MM&P) to ensure that they knew of the inquiry and to ensure that they had an opportunity to provide input. Contact with the regional vice president of MM&P resulted in a referral to a member of the union who was a Washington State Ferry employee and who served as the union's representative throughout the inquiry. Additionally, MM&P sent a letter to their members informing them of the inquiry and providing a Coast Guard contact point for those who wanted to let their thoughts on the subject be known. Many telephone interviews were conducted with MM&P members as a result of the mailing.

During the inquiry, a review of the current operating schedules for licensed deck individuals showed compliance with governing laws and regulations pertinent to work hours and crew rest. The vessels are manned as required by their Coast Guard issued Certificates of Inspection and there is no evidence that the manning requirements should be revised. Although the review of the Washington State Ferry casualty reports does not support a conclusion that crewmember fatigue has significantly affected the safe operation of the vessels, it does appear that the current schedules could result in some degree of fatigue in certain of the vessels' crewmembers. While these personnel appear to be provided with the opportunity to receive rest between work periods, personal habits of crewmembers have apparently resulted in these periods not being fully utilized for rest by some individuals.

5730

Subj: RESULTS OF COAST GUARD INQUIRY INTO OPERATION OF WASHINGTON STATE FERRIES

A variety of solutions exist and it is within the ability of the Washington State Ferry system to resolve the problem by taking actions to reduce the likelihood of crewmember fatigue thus enhancing safe vessel operation. Although some schedules were changed after the Sparks' report, further schedule modifications appear possible. As an example, the engineers' schedules appear to be working satisfactorily. Another solution could be the implementation of a requirement that crewmembers remain on board the vessel during their off-watch periods. If necessary, the habitability of the crewmembers' quarters could be improved.

If your Committee determines that a statutory amendment specifying watch or work hour provisions is necessary to resolve the situation, the amendment could have significant impact on the operations of all vessels operating on inland waters. Such an amendment would have to be carefully constructed to account for a myriad of operating conditions and schedules, not the least of which are the unusual operating periods sometimes inherent in the operations of a ferry service.

Enclosed is a synopsis of the results of the Coast Guard's inquiry.

Sincerely,

P. A. YOST
Admiral, U.S. Coast Guard
COMMANDANT

Enclosure

Synopsis of Inquiry
on Work Hours on Washington State Ferry Vessels

DISCUSSION: The Commander, Thirteenth Coast Guard District, Seattle, Washington, conducted an inquiry into the incidence of fatigue among personnel operating the Washington State Ferries (WSF). The objective of the inquiry was to determine if operational safety of WSF vessels has been adversely affected by the cumulative effects of the work schedules in effect for deck officers and other navigation watch personnel. The inquiry included a review of a number of existing scientific studies related to shift work and its effects on workers, interviews with WSF management personnel, and interviews with WSF employees affected by the schedules. Twenty-three individuals were interviewed and five persons submitted material through the mail for consideration. Due to the time constraints imposed, there was insufficient time to study the extensive list of studies, reports, and opinions provided in the Congressional committee's listing or interview the individuals listed as subject matter experts.

The majority of those providing input were dissatisfied with the schedules. A small number of interviewees, including a few employees and all the WSF management personnel interviewed, are content or find the schedules to be acceptable given the factors which have gone into their development. Everyone interviewed was in general agreement that prior to crew cutbacks resulting from budget cuts in 1982/83, there were few problems associated with the crew schedules. The budget cuts resulted in the loss of personnel required to work graveyard shifts which led to the loss of straight eight hour rotations. Consequently, a variety of schedules have been implemented over the years in response to WSF budgetary limitations, labor negotiations, and ridership demands.

FINDINGS: The findings and conclusions which follow are based on the information provided by those interviewed or submitting material, review of available scientific information on the topic, and a report from the Coast Guard Marine Safety Office, Puget Sound, concerning casualty investigation records pertaining to reported casualties involving WSF vessels.

Out of the casualty reports available involving damage to property, only one report contains an indication that fatigue was a contributing factor. That casualty occurred in 1983 and involved the grounding of the ferry ISSAQUAH.

A review of the current operating schedules for licensed deck individuals shows compliance with governing laws and regulations pertinent to work hours and crew rest. The vessels are manned as required by their Coast Guard issued Certificates of Inspection and there is no evidence that the manning requirements should be revised.

Although many of the vessels have what appear to be adequate berthing facilities for the deck personnel, most of those personnel interviewed considered the quarters to be unsuitable for getting adequate rest between

ENCLOSURE(1)

watches due to: noise created by active watchstanders, noise and vibration/movement induced by the maneuvers associated with making frequent landings, activity associated with embarking and disembarking passengers and vehicles, and poor ventilation and temperature control. Such comments, however, are inconsistent with the fact that several of the deck personnel and many of the engineering department employees do stay aboard some of the vessels between watches and apparently obtain adequate rest.

The engineering officers work different schedules from their counterparts in the deck department. The engineers appear to be satisfied with their schedules and there is no indication of any safety problems associated with their work hours. The engineers generally work a 12-on, 12-off workday for a period of 7 days, followed by 7 days off. They are assigned to a specific vessel and move with that vessel to whatever route the vessel is assigned. They often live on board the vessels and many do not routinely go home between watches.

The deck officers work a variety of shift schedules, are assigned to specific routes rather than to a vessel, do not usually live on board the vessels, and frequently try to go home between watches even when the commute uses up a significant portion of the available rest time. Most of the deck officers have resisted working the same shifts as the engineers for a variety of reasons. Most of the reasons given during the inquiry appeared to be based more on personal convenience than other concerns.

CONCLUSION: A review of the current work schedules for the navigating watch personnel on the WSF vessels vis-a-vis the findings and recommendations of the various studies resulted in a conclusion that affected employee performance levels may suffer and become a serious problem after an extended period of working the unusual times and frequent changes called for by the schedules. The cumulative effects of existing schedules have apparently created situations where many of the navigating watch standers feel they are not operating at or near optimum performance levels. The undesirable effects of the schedules are aggravated by the stress which normally accompanies the work, such as congested traffic situations, long periods of monotony and boredom, seasonal fog and inclement weather, and frequent landings which exercise the shiphandling skills of any navigating bridge team. These effects seem to have manifested more rapidly in the older employees, but eventually all age groups are impacted negatively. The WSF safety manager, however, reported that he has received no complaints relative to the work schedules since the current schedules were put into effect in late 1987.

The deck officer work schedules are somewhat modified from those in effect at the time of the Sparks report concerning the WSF operations. Those modifications reflect an effort by WSF to incorporate some of Dr. Spark's recommendations. In the Sparks report there are a number of references to near misses or actual accidents involving WSF vessels in which those involved indicate that fatigue was a primary or contributing factor. There are not, however, a corresponding number of official logs, incident reports, or inquiry reports to support such allegations. In fact, in discussing this topic with various crew members, there are those who believe that the Sparks survey questionnaires may have been inaccurately completed by some who exaggerated the situation in an attempt to influence the findings of the survey. It is recognized, however, that events which do occur (i.e. near misses) may often not be reported, as few people will put themselves on report for falling asleep on watch.

U.S. Department of Transportation
United States Coast Guard

Commandant
United States Coast Guard

Washington, D.C. 20593-0001
Staff Symbol: G-CC/104
Phone: 366-4280

5730
OCT 26 1988

The Honorable Earl Hutto
Chairman, Subcommittee on Coast Guard
and Navigation
Committee on Merchant Marine and Fisheries
House of Representatives
Washington, D. C. 20515-6230

Dear Mr. Chairman:

The attached Questions and Answers for the Record of your Committee's hearing on 31 May 1988, concerning Ferry Vessel Safety on Puget Sound are submitted as per your request. All responses have been reviewed and approved, as required by the Department of Transportation and the Office of Management and Budget.

Please do not hesitate to call if I can provide further assistance.

Sincerely,

R. T. Rufe
Captain, U. S. Coast Guard
Chief, Congressional Affairs Staff
By direction of the Commandant

Enclosure: (1) Qs and As for Congressman Mike Lowry, 1-8

Copy: (1) Ms. Sherry Steele, Minority Staff

CONGRESSMAN MIKE LOWRY QUESTIONS
WITH COAST GUARD ANSWERS: #1
FERRY VESSEL SAFETY ON PUGET SOUND HEARING, 31/05/88

QUESTION. THESE REGULATIONS HAVE BEEN IN THE DEVELOPMENT STAGE SINCE 1984, WHEN DOES THE COAST GUARD ANTICIPATE PUBLICATION OF THE PROPOSED CHANGES?

Answer. We anticipate publishing the Notice of Proposed Rulemaking this Fall. As you pointed out, the regulations are broad in their effect, in that they proposed changes in the lifesaving regulations for all large inspected vessels, and result in a major reorganization of the lifesaving regulations for these vessels. The result is a draft regulation package 450 typewritten pages long. This extensive package must finish the Coast Guard review process, which may take another month.

CONGRESSMAN MIKE LOWRY QUESTIONS
WITH COAST GUARD ANSWERS: #2
FERRY VESSEL SAFETY ON PUGET SOUND HEARING, 31/05/88

QUESTION. DO YOU ANTICIPATE INCREASES IN THE MANNING LEVELS ON THE WASHINGTON STATE FERRIES AS A RESULT OF THESE REGULATIONS?

Answer. While the NPRM is still undergoing review, we do not anticipate that the regulations will specifically require increases in manning levels. We believe the regulations will contain enough flexibility for the Washington State Ferries to design a lifesaving system that will not require increases in manning levels. However, a decision on manning levels can only be made after deciding upon a lifesaving system design.

CONGRESSMAN MIKE LOWRY QUESTIONS
WITH COAST GUARD ANSWERS: #3
FERRY VESSEL SAFETY ON PUGET SOUND HEARING, 31/05/88

QUESTION. FROM A MEDICAL STANDPOINT, IS SIX HOURS OFF BETWEEN SHIFTS AN ADEQUATE AMOUNT OF TIME FOR REST AND RECOVERY FOR THE CREW MEMBERS?

Answer. The Coast Guard is not aware of any generally accepted medical opinions that conclude that six hours off between shifts is an adequate amount of time for rest and recovery of vessel crewmembers. Many factors appear to preclude such a generalization. These factors include, but are not limited to: nature of activities or duties performed prior to and subsequent to rest periods; period of time these activities or duties are performed; number of days spent in a particular work/rest schedule; rotational shifts in the work schedule; and, environmental factors such as vessel movement, noise, daylight or darkness. Additionally, individuals on the same work schedule can be affected differently, i.e. factors that cause fatigue in one individual may not cause fatigue in another individual.

It should be noted that on a significant number of vessels in the U.S. maritime industry crewmembers are assigned to continuous six hours on duty and six hours off duty work schedules, without detriment to vessel or personal safety.

CONGRESSMAN MIKE LOWRY QUESTIONS
WITH COAST GUARD ANSWERS: #4
FERRY VESSEL SAFETY ON PUGET SOUND HEARING, 31/05/88

QUESTION. IS FOUR HOURS OFF ADEQUATE?

Answer. Our response to this question is the same as our response to the question concerning the adequacy of six hours off between shifts; however, the Coast Guard is not aware of any segment of the U.S. maritime industry in which vessels' crewmembers continuously receive only four hours off between consecutive work shifts.

CONGRESSMAN MIKE LOWRY QUESTIONS
WITH COAST GUARD ANSWERS: #5
FERRY VESSEL SAFETY ON PUGET SOUND HEARING, 31/05/88

QUESTION. DID YOUR EVALUATION OF THE WORK SCHEDULES INVOLVE THE EXAMINATION OF THE ROTATING SHIFTS?

Answer. The Coast Guard's inquiry into the incidence of fatigue among Washington State Ferry personnel and its impact upon the safe operation of these vessels, considered the rotating shifts that some crewmembers work. However, the inquiry was limited to: reviewing a number of scientific studies relating to shift work and its effects on workers; interviewing Washington State Ferry management personnel and ferry employees affected by the schedules; and, reviewing available Washington State Ferry casualty reports involving damage to property.

CONGRESSMAN MIKE LOWRY QUESTIONS
WITH COAST GUARD ANSWERS: #6
FERRY VESSEL SAFETY ON PUGET SOUND HEARING, 31/05/88

QUESTION. WHAT DID YOU CONCLUDE ABOUT THESE SHIFTS?

Answer. The Coast Guard concluded that schedules for licensed deck individuals show compliance with governing laws and regulations pertinent to work hours and crew rest. However, it did appear that the work schedules could, in part due to the rotating shifts, result in some degree of fatigue in certain vessel crewmembers. Although the work schedules, even with the rotating shifts, appear to give personnel an opportunity to rest between work periods, the personal habits of some crewmembers apparently resulted in these periods not being fully used for rest. The Coast Guard further concluded that a variety of solutions exist, and that the Washington State Ferry System has the ability to resolve the problem.

CONGRESSMAN MIKE LOWRY QUESTIONS
WITH COAST GUARD ANSWERS: #7
FERRY VESSEL SAFETY ON PUGET SOUND HEARING, 31/05/88

QUESTION. WHAT IS THE STANDARD AMOUNT OF TIME OFF BETWEEN SHIFTS FOR COAST GUARD PERSONNEL ASSIGNED TO COAST GUARD VESSELS?

Answer. Generally, Coast Guard personnel assigned to Coast Guard vessels stand four hour watches followed by eight hours off watch; however, the individuals are assigned additional duties which must be performed during the off watch periods.

CONGRESSMAN MIKE LOWRY QUESTIONS
WITH COAST GUARD ANSWERS: #8
FERRY VESSEL SAFETY ON PUGET SOUND HEARING, 31/05/88

QUESTION. DOES THE COAST GUARD REQUIRE FERRY VESSEL OFFICERS TO BE RELIEVED OF HIS OR HER DUTIES IF THE VESSEL OFFICER IS FATIGUED TO THE POINT OF NOT BEING ABLE TO PERFORM HIS OR HER DUTIES?

Answer. Continued performance of duties by a licensed individual who is fatigued to the point of not being able to perform assigned duties could subject both the individual and the individual's supervisers to administrative or criminal proceedings under Subtitle II of Title 46, United States Code (see 46 U.S.C. 2302 and 7703). However, the Coast Guard does not specifically require, in regulation, that such a licensed individual be relieved of assigned duties.

Canadian Coast Guard
Garde côtière canadienne

224 West Esplanade
North Vancouver, B.C.
V7M 3J7

Your file Votre référence

Our file Notre référence

9450-9

June 6, 1988

Ms. Nancy Tyson
Legislative Assistant
U.S. House of Representatives
House Annex II
Room 542
Washington, DC
20515

Dear Ms. Tyson,

Re: House of Representatives Subcommittee on Coast Guard and Navigation

As promised at the close of the hearing in Seattle May 31, 1988 I am pleased to provide some clarification of the process we follow in Canada in establishing the requirements for lifesaving equipment on passenger vessels. At the same time I would attempt to correct some misunderstandings that may have arisen during the various presentations made at the hearing.

It should be noted at the outset that our primary, and indeed only, interest is in the ferries that operate between the United States and Canada. One of these is the "KALEETAN", between Anacortes, WA and Sidney, B.C. and owned by the State of Washington: the other being the "COHO", owned by Black Ball Transport Inc. and operating between Port Angeles, WA and Victoria, B.C. The latter vessel was not the subject of your hearing; its lifesaving equipment relative to the number of passengers is somewhat greater than in the case of the "KALEETAN" but still far short of the 100% coverage required on comparable Canadian ferries.

I would emphasize the word "comparable" as it was suggested that the ferries in British Columbia differed from those in Washington; the latter being commuter ferries and ours being excursion boats operating along our coasts.

Such is simply not the case. The major routes on our coast are between the mainland and Vancouver Island (two in number) and across one of the long inlets which indent our coast. These routes are served by a total of twelve vessels of a size comparable to the major units in the Washington state fleet. A number of smaller vessels serve several lesser routes and two large vessels operate on a service linking coastal communities and the Queen Charlotte Islands.

The number of vessels in service varies depending on the season of the year; in the summer there being a natural increase in the number of tourists. Regardless of the season the majority of the passengers could fairly be described as commuters and a substantial proportion of the vehicular traffic as commercial. In short, the ferries in question form an essential part of the highway system in the Province of British Columbia.

At the hearing it was implied that the 100% coverage on our ferries was in some way linked to the type of structural fire protection fitted. This is not so; our requirement being the same regardless of such a consideration. The requirement is based on those of the various Safety of Life at Sea Conventions and has been applied to our ferries consistently on both international and domestic voyages.

In the event of an abandon-ship situation we do not consider the vehicle deck as an appropriate embarkation deck. The incident forcing abandonment may well be a fire on that deck or, if the vessel was heeling to any great degree, vehicles might break loose or overturn. In any event, access to such deck via lengthy stairways and the lack of free space on the deck would make it extremely difficult to control passengers in such an emergency.

We require that the passengers board the lifeboats or liferafts at a level above the vehicle decks and that they then be lowered to the water. Since the abandonment has to be effected within 30 minutes it becomes a relatively simple process to determine how many launching davits are required. We allow eight inflatable liferafts per davit and each davit requires three persons to operate it.

We do not require that a crew member be assigned to each raft; rather that at least 75% of the crew be certificated lifeboatmen and that the remainder be adequately instructed in the operation of liferafts.

To cater to the different passenger loads that may be encountered in different seasons or on the various routes we have confirmed a multi-tier system as indicated on the attached copy of an inspection certificate for the "Queen of Vancouver". This shows how the number of crew and of certificated lifeboatmen increases in relation to the number of passengers.

.... 3

The above mentioned 30 minute abandonment time is extended for a three month period each year to 35 minutes. This allows the vessels to carry more passengers when equipped with more rafts, but requires the vessel to carry two more crew members for additional passenger control. Other conditions are imposed; for example, that the route be served by more than one vessel, that a frequency of not more than one hour between departures is maintained from each terminal and that at no point on the crossing would the time exceed 30 minutes before passing another ship. The latter requirement effectively eliminates the special allowance on the first and last crossing each day.

I have not addressed the two other matters reviewed by your subcommittee; our major interest being with regard to lifesaving equipment and manning.

We are aware of other requirements of various international conventions from which both the "COHO" and the "KALEETAN" have been exempted but which are applied to our domestic ferries. Since they did not come before the subcommittee I do not feel it appropriate to elaborate on them.

Once again I would express my thanks for having had the opportunity to attend the hearing and to meet you. I trust the foregoing will be of some help to you.

Yours truly,

R.P. Burnside
Regional Manager
Ship Safety

RPB/kc

9562-0/518
Form S.I.C. 16

Issued by the DEPARTMENT OF TRANSPORT CANADA

INSPECTION CERTIFICATE

FOR

A SHIP TO WHICH THE SAFETY CONVENTION DOES NOT APPLY
PLYING AS A PASSENGER SHIP ON.. HOME TRADE ..... VOYAGES CLASS.. III .....

NAME OF SHIP	OFFICIAL NUMBER	GROSS TONNAGE	PORT OF REGISTRY
QUEEN OF VANCOUVER	318636	9357.22	VICTORIA, B.C.

THIS IS TO CERTIFY:-

1. That the above mentioned ship has been duly inspected in accordance with the provisions of the CANADA SHIPPING ACT, that the provisions of that Act respecting the inspection of steamships that are applicable to such ship have been complied with and that the ship is, subject to such limitations as may be specified herein, fit to ply as a steamship, Class.... III.. with the number of passengers stated below:-

Number of passengers	Number of crew	Total passengers and crew
A 1360 B 1163 C 767 D 450	34 31 27 21	1394 1194 794 471

If any of the spaces measured for passengers is occupied by cargo, cattle or stores, one passenger is to be deducted from the number stated above for every 12 superficial feet so occupied.

2. That the ship is marked with subdivision load lines indicated as follows:-

Subdivision load lines assigned and marked on the ship's sides at amidships	Freeboard	To apply when spaces in which passengers are carried include the following alternative spaces
----	1908 MM	---

3. That the inspection showed
(a) that the main boilers may carry a working pressure not in excess of .... -- ..... kPa
(b) that the auxiliary boilers may carry a working pressure not in excess of .... 345 ..... kPa
(c) that the air receivers may carry a working pressure not in excess of .... 1034 & 2069 ... kPa
(d) that the ship carried
(i) ... 4 ..... boats, capable of accommodating ..... 218 ..... persons,
(ii) ..... -- ..... rigid liferafts, capable of accommodating ..... -- ..... persons,
(iii) ..... 54 ..... inflatable liferafts, capable of accommodating ..... 1350 ..... persons,
(iv) ..... -- ..... buoyant apparatus, capable of supporting ..... -- ..... persons,
(v) ..... 14 ..... lifebuoys, 1394 A 140 C lifejackets, A 26 B 24 C 21 D 16 certificated lifeboatmen.

LIMITATIONS ON USE OF CERTIFICATE:-

(1) This certificate shall be valid only for voyages as follows:-
HOME TRADE CLASS III
EAST OF RACE ROCKS, SOUTH OF CAMPBELL RIVER
The validity of this certificate shall be contingent on the log card of each inflatable life raft carried, being endorsed annually by the supplier's accredited serviceman. 18/12/86

(2) This certificate shall not be valid for any voyage made after ..... or before .....

(3) The special passenger allowance of ..... persons shown above is for the period from ..... to .....

This certificate is issued on ..... 11TH DECEMBER 1986 ..... and is valid until 19TH DECEMBER 1986

A.E. FURMEDGE
Steamship Inspector, as to the machinery and fire extinguishing equipment for the machinery space.

A.E. FURMEDGE
Steamship Inspector, as to the hull and equipment, other than fire extinguishing equipment for the machinery space.

NOTES: (1) This certificate is to be posted in a conspicuous place on board the ship.
(2) Masters and owners should ensure that the vessel is so loaded and ballasted as to secure proper measure of stability.
(3) The Canada Shipping Act provides penalties for overloading.
(4) The Canada Shipping Act requires the master or owner of a ship, which has sustained damage affecting her seaworthiness or her efficiency, to report the matter to the Chairman of the Board of Steamship Inspection as soon as possible. This report may be forwarded through the nearest Divisional Supervisor, Steamship Inspection Service.
(5) This certificate shall cease to be in force if alterations are made in the subdivision of the hull or if changes are made in the conditions of operations which affect the position of the subdivision load lines when applicable.

05-0033
10-78

DUANE BERENTSON
Secretary

STATE OF WASHINGTON
DEPARTMENT OF TRANSPORTATION
Marine Division, Washington State Ferries, Colman Dock (Pier 52) • Seattle, Washington 98104 • (206) 464-7800

July 29, 1988

Representative Earl Hutto, Chairman
Subcommittee on Coast Guard
and Navigation
Room 1334
Longworth House Office Building
Washington, D.C. 20515-6230

Dear Mr. Chairman:

Enclosed are our responses to the follow-up questions posed by Congressman Lowry (D-WA) and transmitted by your letter of July 7, 1988.

Very respectfully,

H.W. PARKER
Assistant Secretary for
Marine Transportation

HWP:br
Enclosure
H366.L

RESPONSES TO QUESTIONS
FOR THE RECORD
FROM CONGRESSMAN MIKE LOWRY

LIFESAVING

QUESTION: As I understand, the Washington State Ferries recently purchased several inflatable buoyant apparatuses which will carry about 45 passengers. What promoted you to purchase these and how have they worked?

ANSWER: Purchase of Viking Buoyant Apparatuses was promoted by concerns for passenger safety expressed by passengers and some crew members.

The Viking Buoyant Apparatus was requested on April 19, 1984, and arrived in the country on December 30, 1984.

The plan for installation was based on vessel route assignment and average passenger load capacity.

WSF has never had to deploy life raft or buoyant apparatuses. It has only been witnessed during tests and performed satisfactorily.

CREW FATIGUE: WASHINGTON STATE FERRY VESSELS

QUESTION: In its investigation, the Coast Guard did not find the safe navigation of the vessels to be in jeopardy as a result of the crew fatigue. However, the Coast Guard did state that the current work schedules could result in some degree of fatigue. I am concerned that chronic crew fatigue has the potential to reduce the effectiveness of the vessel officers.

From a medical standpoint, is six hours off between shifts an adequate amount of time for rest and recovery for the crew members?

ANSWER: I am not qualified to answer your question from a medical standpoint. From an operations standpoint, WSF currently has about 95% of its shifts scheduled with at least 8 hours off between watches.

QUESTION: Is four hours off adequate?

ANSWER: Again I am not qualified to answer. From an operational standpoint this is not a problem with WSF.

QUESTION: One of the medical concerns raised by the crew members involves the rapid rotation of work schedules. Medical literature seems to indicate that if shifts are to be rotated they should be rotated no more frequently than every three weeks.

Have you examined the current work schedules to determine if changes can be made which would result in rotating shifts generally being more consistent with up to date medical recommendations.

ANSWER: At this time a complete review of all work shifts has not been completed. We anticipate the Schedule Committee will complete this task.

QUESTION: As I understand, the Sparks' study examined the work shift problems on the Bremerton run only. Is WSF planning a follow-up study to the Sparks' survey?

ANSWER: At this time WSF has not made a final decision regarding this matter.

QUESTION: Was this a recommendation of Dr. Sparks?

ANSWER: Dr. Sparks did state that it may be worthwhile to re-survey the members of the Bremerton crews one year after the changes were implemented.

QUESTION: Does the Ferry System have any plans to study other vessel runs to determine the extent of crew fatigue?

ANSWER: Not at this time. Any requests to review other vessel runs to determine crew fatigue will be initiated by the Joint Labor/Management Committee, established for that purpose.

QUESTION: The current labor agreement between the Washington State Ferries and the Masters, Mates, and Pilot's Union provides for a special committee comprised of officers and Ferry System personnel to address scheduling problems. I would like to be kept apprised of the progress of the committee.

Have the committee members been named? If so, who are the committee members?

ANSWER: The committee consists of: Armand Tiberio, WSF Management; David Black, WSF Management, Captain Tom Jacobs and Chief Mate Gary Fredback.

QUESTION: When is the committee scheduled to meet?

ANSWER: July 28, 1988

QUESTION: Are medical experts being consulted by the committee to insure that shifts reduce crew fatigue and maximize worker potential?

ANSWER: It is anticipated that Dr. Sparks will be consulted from time to time regarding work shifts.

QUESTION: Currently what guidelines does WSF follow while developing crew schedules? Do these guidelines include scheduling methods to minimize crew fatigue?

ANSWER: The guidelines were developed and supplied to WSF by Dr. Sparks. These guidelines were introduced into the record at the formal hearing.

Scheduling methods are not included in the guidelines.

QUESTION: Has the Washington State Ferry System considered hiring an outside consultant to help develop work schedules which meet the needs of the riders and the Ferry System Management while also providing for healthful work hours for the vessel employees?

ANSWER: Other than employing Dr. Sparks and following the guidelines she outlined, we have not considered any other outside consultants. If the findings of our special committee indicate a need we will then give it consideration.

June 7, 1988

The Honorable Mike Lowry
Chairman, Subcommittee on Oceanography
Committee on Merchant Marine and Fisheries
House of Representatives
Washington, D. C. 20515

Dear Congressman Lowry:

Thank you for bringing attention to the work scheduling problems at Washington State Ferries. After reviewing the written testimony by the United States Coast Guard and the Washington State Ferry management, I would like to comment on them.

I feel the Coast Guard report is a reasonable one; however, let it be known that the time frame for input from masters and mates was very limited. I sent out a letter to all masters and mates on a Friday stating their input was needed by the following Wednesday. Many did not have adequate opportunity to respond.

Admiral Yost states that some individuals do not utilize time between work periods for rest. This view point is part of the problem: Human beings are not robots with on and off switches. Poor scheduling makes it difficult to obtain decent rest.

The synopsis also states "all WSF management personnel interviewed are content or find the schedules to be acceptable given the factors that have gone into their development." I find this perplexing. After all the time and effort spent attempting to inform these managers about the detrimental effects of poor shift scheduling, WSF management still takes a lackadaisical attitude toward it.

WSF management testimony states that prior to 1982 - 1983 there was no work schedule dispute systemwide. This is only partly true; concerns were raised by employees regarding adverse effects of shiftwork. When the Seattle-Bremerton schedules were implemented the situation came to a head. The hours, as described by researchers, were brutal. Instead of making steps in the right direction, WSF was instead moving backward.

The WSF management testimony glosses over the WSF accident reported in USCG investigative records which cited fatigue as a contributing factor. The testimony fails to mention this was a grounding with an accompanying fire in the engine room. The testimony also fails to mention such incidents as a quartermaster falling asleep at the wheel while standing up and continuing to steer through Rich Passage (very narrow) in the fog. WSF testimony also makes no mention of the numerous letters from doctors expressing concern over employees' health due to abysmal work schedules.

The Coast Guard report states that "employee performance levels may suffer and become a serious problem after an extended period fo time working the unusual times and frequent changes called for by the schedules." In WSF reference to Dr. Sparks' report they say that no bonafide reason exists to amend the regulations. However, Dr. Sparks states that "changes in current shift schedules . . . are recommended to prevent increased sickdays, sleep disturbances, disruption of family and social life of the crew and the serious potential for accidents related to fatigue affecting the public safety."

The WSF testimony states that only by continuous monitoring and assessing of our work schedules can the objectives and guidelines of Dr. Sparks report be realized. I believe their past performance and public statements in this area demonstrate a mere printing of words to soothe members of a Congressional hearing. WSF management believes that since the Bremerton schedules were changed the problem is solved. However, as noted by Dr. Sparks in her followup letter, it is a step in the right direction, not a cureall solution. Having groggy crewmen suffering from jetlag-like symptoms over an extended period of time is a dangerous situation.

The effects of shiftwork cannot be done away with but certainly they can be minimized. Extensive research into the area of shiftwork shows that this can indeed be done. Employers need to be bound by certain guidelines so that employees are not subjected to inhumane practices. In our case, not only is the employee affected, but also the traveling public. Thank you for your consideration.

Submitted for the record.

Sincerely,

Thomas G Jacobs

Capt. Thomas A. Jacobs

Allergy, Immunology and Infectious Disease
Family & Preventive Medicine

Mary Hodgson Rose, MD

Providence Medical Center
Seattle Medical Surgical Group
Suite 100, 550 16th Avenue
Seattle, Washington 98122
Phone: (206) 329-0200
After hours: (206) 622-2337

May 16, 1988

Congressman Earl Hutto
Chairman, Coast Guard and Navigational Subcommittee
United States House of Representatives
Room 547, House Annex Two
Washington, D.C. 20525

Dear Mr. Hutto:

I am writing in the hope that my input will be of value to you in your committee's consideration of the health effects of shift work on the performance, reliability, and resultant safety considerations in ferry workers and others. I am a physician, board certified in family medicine, who has had the opportunity to care for a number of such patients over a period of about 15 years. During the first part of this time I was practicing in Anacortes, Washington, where I cared for a substantial number of patients who worked on the ferries and also others who did shift work at the Texaco and Shell oil refineries. Since moving to Seattle I have seen other patients who worked in the state ferry system.

I would like to try to present a composite summary of the problems and methods of adaption which these patients present. They share in common a disruption of bodily functions dependent on a biological clock which regulates sleep and waking on a predetermined schedule for each 24 hour period. They have particular trouble because the shift work they are required to do switches back and forth, so that at one time they are required to stay up very late at night, then sleep in, and then to reverse this process, being required to go to bed very early and get up at about the time they would have previously gone to bed. Staying up late and sleeping in is not insurmountable for most patients. Most troublesome is trying to go to sleep at the time when they would have ordinarily arisen — something which many find nearly impossible.

Most patients report an initial period when they were able to tolerate such shift changes. While often tired, they liked their jobs and made efforts to adapt. Virtually all used some form of drugs to try to control their sleep/waking cycles, turning on sleep on demand and trying to produce alertness when it was necessary. Use of coffee, over the counter sleeping aids, and sometimes alcohol has been almost universal. As these workers leave their youth and begin to be more troubled by the rapid disruptions of the biological clock, they report a variety of symptoms. The first and persistently most troublesome is inability to go to sleep at the time that the shift permits. Resultant sleep deprivation is associated with confusion, poor memory, anxiety and irritability. A disorted sense of time is often reported with difficulty getting things done. Falling asleep while trying to drive home after work is an oft reported problem, and several patients have reported accidentally driving off the road and near accidents while in this state. Unfortunately, a number of patients have resorted to additional drug use to try to regulate their sleep/waking cycles. Some have used illegal drugs, including cocaine and amphetamines. Others have become dependent on sleeping pills and alcohol. It is not uncommon for a series of such substances including the above mentioned illegal drugs to be used in the course of a 24 hour period in an escalating effort to remain awake at work and to manage their sleep deprivation after work. Marked irritability, disrupting home and family life, has been reported by a number of workers. Severe inability to carry out treatment regimens for common illnesses such as high blood pressure, diabetes, and asthma has also occurred, because constant changing of sleeping and eating patterns makes adherence to a medication schedule very difficult.

In my management of these patients it has been utterly impossible to avoid the use of drugs. All known non-drug methods of handling sleep disturbances require that the biological clock be reestablished. A prime necessity is a definite time for getting up in the morning. Patients are taught various relaxation and learning methods in order to achieve sleep and waking in an orderly fashion. The constant shifting or work time makes this impossible in this group of

patients. My best efforts have consisted of treatment of the multiple stress-related health problems, such as hypertension, peptic ulcers, alcohol and other substance abuse, and substitution of non-addicting drugs to permit sleep onset when the schedule requires. These patients require a lot of support just to maintain themselves from day to day, and remain at continued risk for falling asleep at work or during the performance of skilled tasks such as driving. Problems with their judgment and emotional stability are also ongoing.

While I realize it has historically been part of the ambiance of the state ferry system to require changing shift work of all of its workers, I see no reason why this sytem could not be replaced by one which incorporates our new knowledge of the biology of sleep and waking and its powerful impact on physical and mental health. I would strongly encourage the committee to require new work schedules which respect these biological imperatives and do not put a steady succession of workers into this physiologically untenable situation.

If I can be of any further assistance or provide additional information, please do not hesitate to call on me.

Sincerely,

Mary H. Rose, M.D.

Mary H. Rose, M.D.

340/22